TAKING TURNS

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I. INTRODUCTION

Two siblings jointly inherit their late father's rocking chair. The chair has principally sentimental and no real economic value; it cannot be physically divided between them, and selling it to distribute the proceeds will compensate neither for the sentimental loss. What, then, should become of the disputed property? In a self-confessed

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We dedicate this Article to the memory of Dan Markel (1972-2014), a dear friend, a great scholar, and a mensch.

"strange" decision in the *McDowell* case,[1] the Surrogate's Court of New York ordered that the two siblings take possession of the chair alternately for six-month periods; and, when one passed away, the other would obtain exclusive possession.[2] An allocation method based on alternating enjoyment (or suffering) is commonly known as "rotation," or, more colloquially, "taking turns." Yet, despite its manifestation in different legal contexts and its considerable potential, rotation has been almost neglected by legal theorists. This Article makes the first attempt to delineate and exemplify the proper boundaries of this method's utilization by and under the law, based on a comprehensive and systematic integration of fairness- and efficiency-oriented concerns. In providing a full-fledged theoretical framework, we also aim to alert law and policy makers to the availability of rotation-based solutions to allocative challenges, and to advocate a cautious expansion of their application by and under the law.

As stated above, although rotation is not a common allocation method, its presence in law has not been as scant as one might imagine, and at times it has been advocated by legal scholars as a possible solution for pressing allocative problems.[3] A paradigmatic example of rotation in private law is the allocation of physically indivisible property among co-owners. The greatest common law jurists observed this principle centuries ago. Edward Coke discussed the problem of several persons inheriting an indivisible resource, suggesting that it should be resolved through rotation.[4] William Blackstone similarly explained that if it is impossible to allocate a jointly owned resource to one of the coparceners and fairly compensate the others ("partition by allotment"),[5] they should "have the profits of the thing by turns."[6]

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1. *In re* Estate of McDowell, 345 N.Y.S.2d 828, 830 (N.Y. Sur. Ct. 1973) (stating that its decision "may sound strange").

2. *Id.* This decision is briefly mentioned for its uniqueness in the classic hornbook on property law. JESSE DUKEMINIER ET AL., PROPERTY 300 (6th ed. 2006).

3. *See, e.g.*, sources cited *infra* notes 18, 80-86.

4. 2 EDWARDO COKE, THE FIRST PART OF THE INSTITUTES OF THE LAWS OF ENGLAND bk. 3, ch. 1, § 241, at 165a (18th ed., London, Luke Hansard & Sons 1823) ("[O]ne coparcener [shall] have the estovers, pischary, or common, &c. for a time, and the other for the like time; as the one for one yeare, and the other for another, or more, or lesser time, whereby no prejudice can grow to the owner of the soile. Or in case of the pischary, the one may have one fish, and the other the second, &c. or the one may have the first draught, and the second the second draught, &c. And if it be of a park, one may have the first beast, and the second the second, &c. And if of a mill, one to have the mill for a time, and the other the like time; or the one one toll dish, and the other the second, &c. And this appeareth to be the ancient law.").

5. *E.g.*, Zimmerman v. Marsh, 618 S.E.2d 898, 901 n.2 (S.C. 2005) (explaining that "one joint owner is allotted the entire property" and pays the others for their respective interests); *accord* Zachary D. Kuperman, Note, *Cutting the Baby in Half: An Economic Critique of Indivisible Resource Partition*, 77 BROOK. L. REV. 263, 290-91 (2011) (discussing partition by allotment).

6. 2 WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND ch. 12, at 190 (10th ed., London, A. Strahan; T. Cadell, In the Strand; & D. Prince, Oxford 1787).

This principle was explicitly endorsed by the legislature in several states, such as Maine (with respect to jointly owned sawmills)[7] and Minnesota (with respect to mills and other indivisible tenements).[8] Another private law example concerns child custody following divorce. Custody is granted on the basis of the interest of the child;[9] but if the child will equally benefit from staying with the mother and with the father, rotation may be applied.[10]

In public law, access to common goods in extremely high demand is sometimes rationed by rotation. One of the most prominent examples is rotational road-space rationing, whereby alternating sets of vehicles, usually defined by license plate numbers, are denied entry to certain metropolitan areas each day, during peak hours[11] or special events,[12] to reduce congestion.[13] Similarly, governmental powers may be allocated by rotation. Political philosopher Barbara Goodwin shows that many utopian thinkers advocated this regime.[14] But real historical examples are also to be found. Under the Qing dynasty in China, the task of serving as "headman" for tax collection was allocated by rotation.[15] In 1984, the largest political parties in Israel established a national unity government in which the two party leaders held the position of Prime Minister by rotation.[16] This constitutes an example for voluntary rotation, permitted by the law. Lani Guinier

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7. ME. REV. STAT. ANN. tit. 14, § 6506 (2015) ("Tenants in common of a sawmill may have a division of the time during which each may occupy according to his interest . . . .").

8. MINN. STAT. § 558.12 (2015) ("When the premises consist of a mill or other tenement which cannot be divided . . . the referees may assign the exclusive occupancy and enjoyment . . . to each of the parties alternately for specified times, in proportion to their respective interests.").

9. JON ELSTER, LOCAL JUSTICE: HOW INSTITUTIONS ALLOCATE SCARCE GOODS AND NECESSARY BURDENS 50 (1992).

10. *See id.* at 73 (discussing the possibility of rotational child custody); H. PEYTON YOUNG, EQUITY: IN THEORY AND PRACTICE 14, 21 (1994) (same); Kuperman, *supra* note 5, at 280 (same); *see also* Francis J. Catania, *Learning from the Process of Decision: The Parenting Plan*, 2001 BYU L. REV. 857, 862 (2001) ("[T]he notion of parents sharing child custody equally (or near equally) swept the nation. Newspapers, magazines, and television documentaries ran stories of children going home to a different household on alternating weeks or parents taking turns living with the children in the designated custodial home.").

11. This method is common in Mexico, Central America, and South America. *See* CAMBRIDGE SYSTEMATICS, INC., CONGESTION MITIGATION COMMISSION TECHNICAL ANALYSIS: LICENSE PLATE RATIONING EVALUATION *passim* (2007), http://www.dot.ny.gov/programs/repository/Tech%20Memo%20on%20License%20Plate%20Rationing.pdf. It was also considered as an alternative to congestion pricing in Manhattan. *See* William Neuman, *Traffic Panel Members Expect to Endorse Fees on Cars*, N.Y. TIMES (Jan. 25, 2008), http://www.nytimes.com/2008/01/25/nyregion/25pricing.html.

12. *See, e.g.*, *Car Restrictions Begin in Beijing*, BBC NEWS (July 20, 2008), http://news.bbc.co.uk/go/pr/fr/-/1/hi/world/asia-pacific/7515907.stm (discussing road space rationing during the Olympic Games).

13. A rotation-based system can also be applied for other reasons, such as reducing gasoline consumption and related externalities.

14. *See* BARBARA GOODWIN, JUSTICE BY LOTTERY 153-60 (2d ed. 2005).

15. ELSTER, *supra* note 9, at 73.

16. *Overview*, ELEVENTH KNESSET, http://knesset.gov.il/review/PrintPage.aspx?kns=11&lng=3 (last visited Feb. 27, 2016).

set out a radical proposal, whereby in a polity divided into a permanent majority and a permanent minority, the majority and the minority should take turns in making collective decisions.[17]

The most obvious example of rotation in federal, supranational, and international law is the allocation of political power among constituents of political unions or transnational bodies. In these cases, power is usually allocated to political entities, not to specific people. For example, the presidency of the German Bundesrat rotates among representatives of the different member states on a yearly basis.[18] Similarly, the chair of the presidency of Yugoslavia was alternately held by leaders of the constituent republics.[19] In fact, Croatia declared its independence because the Serbian leader temporarily succeeded in preventing the Croatian leader from taking his turn.[20] On the transnational level, under the Maastricht Treaty, the Presidency of the Council of the European Union rotates every six months among representatives of EU member states.[21]

However, past and present manifestations as well as suggested applications of rotation have been sporadic, lacking a general unifying theoretical framework for such use in different contexts. This Article fills the theoretical gap. To do so, we first introduce the main variables and conceptual distinctions which the design of rotation-based systems involves, and which a systematic theoretical analysis of the actual and potential role of rotation in the legal system ought to take into account.

Regarding variables, the overall duration of the rotational scheme, the number of participants, and the duration of each "time share" must be established. Obviously, these three variables are mathematically related. If no variable takes an infinite value, then for a given number of participants, the overall duration and the size of individual time shares are directly proportional; for a given individual time share, the number of participants and the overall duration are directly proportional; and for a given overall duration, the number of participants and the extent of individual time shares are inversely proportional. Thus, any decision or constraint concerning each variable impacts the other two, with policy implications. For example, increas-

17. LANI GUINIER, THE TYRANNY OF THE MAJORITY: FUNDAMENTAL FAIRNESS IN REPRESENTATIVE DEMOCRACY *passim* (1994). For a detailed analysis of this proposal, see *infra* notes 82-88 and accompanying text.

18. *See The President and Presidium*, BUNDESRAT, http://www.bundesrat.de/EN/organisation-en/praesident-en/praesident-en-node.html (last visited Feb. 27, 2016).

19. Kellye L. Fabian, Note, *Proof and Consequences: An Analysis of the* Tadic & Akayesu *Trials*, 49 DEPAUL L. REV. 981, 986 n.49 (2000).

20. *Id.* at 987.

21. *See* Consolidated Version of the Treaty on European Union art. 16(9), Oct. 26, 2012, 2012 O.J. (C 326) 24. Until 2009, the head of the European Council (not to be confused with the Council of the European Union) was an unofficial position held by the representative of the state also holding the Presidency of the Council of the European Union.

ing the number of participants or the length of individual time shares might undermine the legitimacy of the entire system, as participants positioned at the end of the roster might be required to be overly patient.

Five conceptual distinctions are also crucial for the design and analysis of rotational systems. The first is between *one-off sequence* rotations, in which each participant receives the resource or bears the burden only once (though possibly for a long period of time), and *repeated-sequence* rotations, in which each participant receives the resource or bears the burden more than once. For example, a one-off sequence rotation of land among three participants (A, B, and C) over a thirty-year period will follow an ABC sequence, and the land will change hands every ten years. A repeated-sequence rotation of the same resource might take the form ABCABCABC, so that each participant will receive the land three times for forty-month terms.[22] The fact that the basic sequence is replicated and each participant can retaliate for "misconduct" by his or her predecessors may have substantial and normatively relevant effects on participants' behavior before, during, and after their turns.[23] It may also contribute to the development of social norms which effectively govern the rotational system.[24]

The second distinction is between *single-object* and *multiple-object* rotations. In the former case, only a single resource or burden is allocated, so every participant enjoys the resource or bears the burden only in his or her turn, and receives or incurs nothing at all other times. In a multiple-object rotation, several resources or burdens change hands, and each participant uses or incurs one of them at any given time, though not the same one continuously. As the participant parts from one resource and hands it over, he or she receives a different resource from another rotating participant. For example, Elinor Ostrom reported a system in which fishermen constantly rotated their fishing spots.[25] An even better example is the rotation of differ-

22. When a resource is not expected to substantially diminish over time, a repeated-sequence rotation can go on indefinitely.

23. *See* ELINOR OSTROM, GOVERNING THE COMMONS 93 (1990) (first citing Robert Axelrod, *The Emergence of Cooperation Among Egoists*, 75 AM. POL. SCI. REV. 306 (1981), *reprinted in* 1 PEACE STUDIES: CRITICAL CONCEPTS IN POLITICAL SCIENCE 267 (Matthew Evangelista ed., 2005); then citing ROBERT AXELROD, THE EVOLUTION OF COOPERATION (1984)) (discussing Robert Axelrod's famous works on game theory and repeat players).

24. *Id.* at 206 (explaining the linkage between repeated interactions, within or outside the rotation scheme, and the development of social norms, stating: "Appropriators . . . who interact with each other in many situations other than the sharing of their CPR are apt to develop strong norms of acceptable behavior.").

25. *Id.* at 19-20.

ent positions or tasks among employees in a particular workplace[26] or among members of a collective community (such as a family or a kibbutz).[27]

The third distinction is between *time-based* rotations, in which the resource passes on to the next participant after the passage of a certain amount of time, and *quota-based* rotations, in which the resource is transferred after reaching a certain level of activity or obtaining a certain benefit.[28] For instance, one fisherman may be required to pass the fishing spot on to another upon catching a certain amount of fish,[29] the flow of water in an irrigation system can be diverted to the next farmer once the current user has used a given quantity of water, etc.[30]

The fourth distinction, fully developed in Part II, is between *equal-share* (or simple) rotation, in which participants' shares in the rotational scheme are equal, and *proportional* rotation, in which participants receive different shares, based on their relative "worth" under an applicable substantive criterion.[31] A proportional design may be used in one-off sequence and repeated-sequence rotations alike.[32] The possibility of adjusting participants' shares to reflect different worthiness or entitlement is not unique to rotation-based allocation methods. For instance, while lotteries often afford equal chances to all pursuers, they may be "weighted"—adjusting each pursuer's chance to his or her relative worth. But using a proportional design in the case of rotation may generate some interesting and distinctive concerns.[33]

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26. GOODWIN, *supra* note 14, at 200; *see* Li-Wen Lin & Curtis J. Milhaupt, *We Are the (National) Champions: Understanding the Mechanisms of State Capitalism in China*, 65 STAN. L. REV. 697, 701, 707, 740-41 (2013) (discussing the practice of rotating positions among executives in China).

27. *See* Abraham Bell & Gideon Parchomovsky, *Property Lost in Translation*, 80 U. CHI. L. REV. 515, 529 (2013) (discussing the kibbutz).

28. *See* OSTROM, *supra* note 23, at 71, 76, 78 (distinguishing various forms of irrigation systems in rural Spain, including rotational systems—some based on fixed time periods and others on the extent of water consumption).

29. *See* JEAN-MARIE BALAND & JEAN-PHILIPPE PLATTEAU, HALTING DEGRADATION OF NATURAL RESOURCES 204 (1996) (discussing the example of salmon fishing in Ireland in the 1970s).

30. *See, e.g.*, Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027, 1078 (1995) (referring to this form as "activity-level division").

31. Elinor Ostrom & Roy Gardner, *Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work*, 7 J. ECON. PERSP. 93, 100 (1993) (providing examples for proportional rotation); *see* MICHAEL WALZER, SPHERES OF JUSTICE 165, 173 (1983) (discussing the allocation of kitchen duties in the Israeli kibbutz, where women were rotated on an annual basis, whereas men only attended two-to-three month shifts).

32. This is often the case with reversions of property rights, when one party receives rights for a specified period, and thereafter the property returns to its owner for perpetuity—clearly an unequal allocation. Ayres & Talley, *supra* note 30, at 1080.

33. *See* Ostrom & Gardner, *supra* note 31, at 106 (explaining that some of the self-rule mechanisms in rotation-based irrigation systems were based on unequal divisions).

The fifth and last distinction is between *mandatory* and *permitted* rotations. In some cases, such as rotational road-space rationing, substantive legal rules allocate particular benefits or burdens by rotation.[34] When rotation is not mandated by the law, it may be permitted in two ways. First, the law can explicitly authorize allocators, including judges, to implement a rotational solution, as in the case of jointly owned sawmills under Maine and Minnesota legislation.[35] Second, in the absence of explicit prohibition, people may voluntarily use rotation. For example, job rotation is a very common employee development strategy among businesses worldwide.[36] It is legally endorsed by recognizing employment contracts, collective bargaining agreements, or workplace practices that bring it into play. Similarly, co-owners of a particular resource may voluntarily adopt a rotational scheme without an external allocator's intervention, insofar as the law recognizes temporary property rights or property sharing contracts. The legal endorsement is thus limited to explicitly or implicitly enabling the use of rotation, and enforcing the ensuing regime.

Turning from the conceptual background to the theoretical framework, this Article uses the fundamental distinction between fairness and efficiency as a cornerstone.[37] "Efficiency" is the maximization of aggregate welfare, and "fairness" is compliance of the process or the distributive outcome with non-welfarist moral criteria.[38] Thus, "fairness" encompasses non-welfarist understandings of both procedural and distributive justice.[39] The fairness-efficiency distinction provides the roadmap for this Article. Part II examines the fairness of rotation-based allocations as a matter of both common perceptions ("positive fairness") and normative ethical commitments ("normative fairness"). On the positive level it argues that although no study has directly examined people's perceptions of rotation in relation to alternative allocation methods, there is ample circumstantial evidence for its perceived fairness. On the normative level, Part II distinguishes between first-order fairness, manifested in the allocator's treatment of the participants, and second-order fairness, namely

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34. *See supra* notes 11-13 and accompanying text.

35. *See supra* notes 7-8 and accompanying text.

36. Lisa A. Burke & Jo Ellen Moore, *The Reverberating Effects of Job Rotation: A Theoretical Exploration of Nonrotaters' Fairness Perceptions*, 10 HUM. RESOURCE MGMT. REV. 127, 127 (2000) (surveying relevant literature); *see also* GOODWIN, *supra* note 14, at 199-200 (defending this practice in terms of job satisfaction and productivity).

37. *See, e.g.*, George P. Fletcher, *Fairness and Utility in Tort Theory*, 85 HARV. L. REV. 537 *passim* (1972); Louis Kaplow & Steven Shavell, *Fairness Versus Welfare*, 114 HARV. L. REV. 961 *passim* (2001).

38. Ronen Perry & Tal Z. Zarsky, *"May the Odds Be Ever in Your Favor": Lotteries in Law*, 66 ALA. L. REV. 1035, 1043 (2015).

39. *See* Gideon Keren & Karl H. Teigen, *Decisions by Coin Toss: Inappropriate but Fair*, 5 JUDGMENT & DECISION MAKING 83, 88 (2010) (making a similar distinction).

the possible impact of first-order fairness on encouraging inter-participant fairness, nourishing broader social and civic virtue, and promoting social justice.

Part III analyzes the advantages and possible drawbacks of rotation in terms of efficiency. It begins by examining the impact of allocating a resource or a burden by rotation on participants' utility following the allocation (ex post effects), and on their behavior prior to such allocation (ex ante effects). Next it explains how rotations might reduce or increase administrative costs. These are divided into several sub-categories related to unique concerns: setting up the rotation scheme, transferring the rotating resource among participants and monitoring the transfers, and administrating ongoing operations when needed. Finally, this Part examines possible effects of rotation on the allocated resource, and on society at large.

This Article demonstrates that different—often conflicting—concerns may arise in different contexts. Initially, various concerns within a single rubric—be it fairness or efficiency—might be incongruent. For example, using rotation in a particular context may increase welfare on one level but reduce it on another. In such a case, an internal balance is necessary to determine whether rotation is comparatively efficient (or fair). Moreover, fairness and efficiency may pull in opposite directions. In such a case, a value judgment is necessary.[40] This Article provides a comprehensive and systematic framework, but its proper use by the judge, the lawmaker, and the policymaker entails a painstaking context-specific and value-laden analysis.

II. FAIRNESS

A. *Overview*

Scholars facing allocation problems in certain settings have considered rotation a "fair," "just," or "equitable" solution; some have done so without further explanation,[41] while others have provided elaborate justifications.[42] We will commonly refer to these accounts as attributing fairness to rotation. This attribution may have two de-

40. *See, e.g.*, Neil MacCormick, *Norms, Institutions, and Institutional Facts*, 17 L. & PHIL. 301, 319 (1998) (discussing cases in which "considerations of fairness take second place to considerations of efficiency").

41. *See, e.g.*, Nicolas Bataille et al., *Efficiency and Fairness When Sharing the Use of a Satellite*, PROC. 5TH INT'L SYMP. ON ARTIFICIAL INTELLIGENCE, ROBOTICS, & AUTOMATION IN SPACE 465, 465-67 (1999), http://adsabs.harvard.edu/full/1999ESASP.440..465B (contending that rotation is the fair allocation method in the esoteric context of allocating a satellite's observation windows among co-funding agents).

42. *See, e.g.*, GOODWIN, *supra* note 14, at 69, 147-66 (substantiating the argument that rotation is "the just method of distribution [in some cases]" and "a distributive device which might in some cases perform the same equitable function as the lottery").

pendent bases. First, people may perceive rotation as a comparatively fair (or unfair) allocation method. We call this "positive fairness." Second, rotation may be fair in terms of non-welfarist moral and political philosophy. We call this "normative fairness." For our present purposes, normative fairness encompasses both distributive justice, which focuses on allocative outcomes, and procedural justice, which focuses on the allocation process.[43] We will discuss the positive aspect in Section II.B and the related normative aspect in Section II.C.

B. Positive Fairness

A preliminary question is why perceptions of fairness matter in the assessment of legal principles. One possible answer is that fairness is defined in terms of actual perceptions.[44] A principle is "fair" if and only if people consider it so.[45] A second possible answer involves legitimacy. There is no point in announcing that a legal regime, more particularly an allocation scheme, is fair if it is incompatible with common perceptions of fairness.[46] A legal regime "require[s] certain value commitments on the part of citizens to be effective,"[47] and people cannot be committed to what they deem unfair. A third possible answer concerns efficiency. Perceptions of fairness matter because complying with or violating one's perception of fairness impinges on one's welfare. Complying with or violating commonly held perceptions may significantly impact social welfare.[48] A fourth answer, which links this Section to the next, is that positive perceptions of fairness often reflect defensible normative accounts of fairness. The fact that people consider a certain principle fair provides prima facie evidence that this principle is defensible in terms of normative fairness. In sum, actual perceptions of fairness are significant not only for understanding, but also for defending and justifying legal re-

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43. *Cf.* James Konow, *Which Is the Fairest One of All? A Positive Analysis of Justice Theories*, 41 J. ECON. LIT. 1188, 1189 (2003) ("The discussion includes both *distributive justice*, which concerns fair outcomes, as well as *procedural justice*, which addresses fair processes . . . .").

44. *Cf.* Alan D. Miller & Ronen Perry, *The Reasonable Person*, 87 N.Y.U. L. REV. 323, 325-26, 370-71 (2012) (discussing the "positive" definition of reasonableness).

45. *See* Konow, *supra* note 43, at 1191 ("Some scholars find the impartial values of real people to be a compelling foundation for an ethical theory.").

46. *Cf.* JAMES GRIFFIN, WELL-BEING: ITS MEANING, MEASUREMENT AND MORAL IMPORTANCE 163 (1988) (making a similar argument with respect to moral restrictions); James L. Gibson, *Group Identities and Theories of Justice: An Experimental Investigation into the Justice and Injustice of Land Squatting in South Africa*, 70 J. POL. 700, 701 (2008) ("[I]nstitutions that rely upon principles of justice not widely shared by the citizenry are likely to have a rocky existence."); M.E. Yaari & M. Bar-Hillel, *On Dividing Justly*, 1 SOC. CHOICE & WELFARE 1, 3 (1984) ("[A] distribution mechanism [is] untenable if its prescriptions are significantly at variance with observed ethical judgments.").

47. Gibson, *supra* note 46, at 701 n.2.

48. *Cf.* Perry & Zarsky, *supra* note 38, at 1069-71 (discussing such effects in the context of lotteries).

gimes. Thus, an important component of any justification for an allocation method is compliance with positive perceptions of fairness.

Alas, while empirical and experimental research abounds on the perceived fairness of other allocation methods, such as queues or lotteries,[49] no study that we know of has directly examined people's perceptions of rotation in relation to the alternatives. Still, circumstantial evidence is ample regarding the perceived fairness of rotation. To begin with, rotation has been *voluntarily* endorsed to allocate common pool resources in the absence of any state intervention. For instance, in the Mustang District in Nepal, farmers planted barley in the winter and buckwheat in the summer.[50] By deciding to water barley fields from the top to the bottom, and buckwheat fields from the bottom upwards, farmers established a season-based rotation of irrigation priority between upper and lower fields.[51] In the Yampa Phant area (also in Nepal), some farmers obtained all the water in an irrigation system on even days and others on odd days.[52] Maintenance tasks were also rotated.[53] Ostrom and Gardner observed that "rotation rules . . . are the common knowledge of all participants on a farmer-governed [irrigation] system."[54] It was said that in these circumstances, "norms that appeal to sentiments of equity . . . come into play."[55] What explains this reality? Presumably, people would prefer not to forgo an advantage unless doing so carries a sufficiently large benefit. In some cases such a benefit exists, making the concession acceptable. In others, people's notions of allocative fairness act as a moderating influence on their pursuit of self-interest.[56] Either way, the fact that people agree to a rotation-based allocation in the absence of any regulation indicates that they consider it "fair."

In addition, empirical studies demonstrate that people frequently perceive "equal splitting" as fair. In various experiments examining different contexts, bargainers inclined to opt for equal splitting of the available resources or burdens even though this was not the economically self-serving option.[57] Arguably, this is an innate ethical percep-

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49. *See generally* Perry & Zarsky, *supra* note 38 (surveying relevant literature); Ronen Perry & Tal Z. Zarsky, *Queues in Law*, 99 IOWA L. REV. 1595, 1604-07 (2014) [hereinafter Perry & Zarsky, *Queues*] (same).

50. Ostrom & Gardner, *supra* note 31, at 99-100.

51. *Id.*

52. *Id.* at 100.

53. *Id.* at 107.

54. *Id.* at 100; *accord id.* at 105, 107-08.

55. Ruth S. Meinzen-Dick & Rajendra Pradhan, *Legal Pluralism and Dynamic Property Rights* 21 (CAPRi, Working Paper No. 22, 2002), http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/127262.

56. *See* Paul Burrows & Graham Loomes, *The Impact of Fairness on Bargaining Behaviour*, 19 EMPIRICAL ECON. 201, 201 (1994) (reviewing relevant literature).

57. *See id.* at 201-02 (reviewing the literature and conditions associated with choosing equal splitting); Elizabeth Hoffman & Matthew L. Spitzer, *Entitlements, Rights, and Fair-*

tion. An experimental study found that "by at least 15 months of age, human infants possess the rudiments of a sense of fairness in that they expect resources to be allocated equally when observing others (third-party fairness)."[58] To the extent that equal splitting is the fairest allocation, and for some reason physical splitting is impossible (or unreasonable, as we will argue below), temporal splitting seems to conform to commonly held perceptions of fairness. One obvious qualification applies. Hoffman and Spitzer's experiment found that people generally followed the principle of desert (giving one what one deserves, mostly in accordance with effort), and that only if there was no morally relevant distinction between them did they "f[a]ll back to egalitarian norms."[59] So while allocating equal shares to equal individuals remains an observed ethical commitment, simple egalitarian rotation will not conform to perceptions of fairness where pursuers have non-equal moral claims. Yet, as we will shortly demonstrate, even if non-equal splitting is mandated by other ethical commitments, such as desert, a generalized form of rotation, which we call "proportional," may be applicable.[60]

Finally, evidence is ample that when facing allocative questions under scarcity, that is, when physical units are not enough to go round, if no clear moral distinction between pursuers exists, people tend to endorse egalitarian allocation methods. For example, Wortman and Rabinowitz carried out an experiment with hundreds of undergraduate psychology students, comparing their perceptions of four methods—merit-based; need-based; first-come, first-served (or FIFO); and random selection—of allocating a scarce good, namely an attractive educational program.[61] Random assignment, which afforded equal chances to all pursuers, was considered the fairest method.[62] Similar research with respect to rotation is lacking. Presumably, however, if an egalitarian method not committed to equal splitting is

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ness: An Experimental Examination of Subjects' Concepts of Distributive Justice, 14 J. LEGAL STUD. 259, 264 (1985) (reporting experimental results).

58. Marco F. H. Schmidt & Jessica A. Sommerville, *Fairness Expectations and Altruistic Sharing in 15-Month-Old Human Infants*, PLOS ONE, Oct. 2011, at 1, 5, http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0023223 (discussing the results of an experiment testing children's decisions in lieu of request for sharing their toys).

59. Hoffman & Spitzer, *supra* note 57, at 283; *see also* Burrows & Loomes, *supra* note 56, at 206 (discussing the results of Hoffman & Spitzer, *supra* note 57).

60. *See* discussion *infra* Section II.C.1.a.

61. Camille B. Wortman & Vita C. Rabinowitz, *Random Assignment: The Fairest of Them All*, 4 EVALUATION STUD. REV. ANN. 177 (1979). Different groups of students were told different stories about which criterion had been used to make the selection, and whether they individually had been successful. All were asked which selection criterion was fairest. *See also* LYN CARSON & BRIAN MARTIN, RANDOM SELECTION IN POLITICS 36-37 (1999) (discussing Wortman & Rabinowitz, *supra*).

62. *See* Wortman & Rabinowitz, *supra* note 61, at 180.

deemed fairer than others, an allocation method which can also secure equal splitting (namely rotation) will be preferable.

C. Normative Fairness

1. First-Order Fairness

a. Equality and Proportionality

The first possible justification for rotation derives from the notion of egalitarianism. In hierarchical societies people are treated according to their relative social rank;[63] so higher ranked individuals may obtain a resource or evade a burden that lower ranked individuals cannot obtain or evade, respectively. In modern egalitarian societies "the provision of a service or opportunity should be based on some ground that is universalistic rather than personally discriminatory."[64] People should not be discriminated against on the basis of gender, sexual orientation, race, ethnicity, appearance, religion, age, political orientation, socioeconomic status, or any other traits deemed irrelevant for purposes of the allocation.[65] Rotation is egalitarian because it ignores irrelevant interpersonal differences[66] and guarantees that all equally positioned participants enjoy the resource or bear the burden; no one is denied the allocated good, excluded from the allocated power, or excused from the allocated burden.[67]

However, the specific mode of operation hinges on the group's nature. The group is homogeneous in the absence of interpersonal differences which are considered relevant for purposes of the allocation, and heterogeneous if such differences exist. We will contend that rotation can be used as a fair allocation method in both cases. Starting with the former, the fundamental principle of distributive justice holds that when participants are equal, that is, the group is homogeneous, they should be treated equally.[68] If participants are equal and rotation treats them equally, its application is fair. Thus, to substantiate a normative justification for rotation in a particular context, we

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63. *See* EDWARD T. HALL, THE SILENT LANGUAGE 157 (1959); *see also id.* at 201 ("[W]here society assigns rank for certain purposes . . . the handling of space will reflect this.").

64. MacCormick, *supra* note 40, at 307.

65. *Cf.* HALL, *supra* note 63, at 201 ("[I]t is regarded as a democratic virtue for people to be served without reference to the rank they hold in their occupational group. The rich and poor alike are accorded equal opportunity to buy . . . in the order of arrival.").

66. *See* ELSTER, *supra* note 9, at 73 (mentioning rotation among egalitarian principles).

67. *See* GOODWIN, *supra* note 14, at 148-49.

68. *See* JON ELSTER, SOLOMONIC JUDGEMENTS: STUDIES IN THE LIMITATIONS OF RATIONALITY 113 (1989) ("Fairness . . . means simply that relevantly like cases should be treated alike.").

need to (1) determine that a state of homogeneity exists and (2) show that rotation treats participants equally.

Let us start with homogeneity. This state is a policy-driven conclusion, not an absolute truth. The most extreme version of homogeneity is based on personhood itself. It assumes that all people are equal, either for the purpose of a specific allocation or generally, and therefore deserve equal treatment irrespective of any personal trait.[69] Although personhood-based homogeneity is relatively rare in the allocation of resources and burdens, it is not unheard of. It exists, for example, in the context of civil rights and liberties (including suffrage) where all people are presumably treated equally.[70] Yet even in this context, an assertion of homogeneity may be an overstatement as the protection of such rights and liberties may depend on citizenship, age, etc. More moderate forms of homogeneity are based on some preliminary screening that rests on morally defensible, substantive criteria, such as need, merit, or skill. In such cases, participants are considered equal because they have similar needs, achievements, or skills, or because they attain a certain threshold based on one or more of these criteria. We will elaborate on these criteria below.

Simple rotation among members of a particular group treats each member equally[71] by providing all with equal access to the resource or subjecting all to an equal share of the burden.[72] But it does so in a seemingly unusual manner that needs to be explained and defended. If participants are equal in all relevant respects, the most straightforward allocation method would be to distribute equal permanent shares of the resource or the burden to all participants. The problem is that in most cases the number of shares into which the resource or burden can be physically divided is smaller than the number of people competing to obtain the resource or to evade the burden.[73] Division may be physically impossible or unwarranted, for example, when it will result in significant reduction in aggregate value, as in the

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69. *See* NEIL DUXBURY, RANDOM JUSTICE: ON LOTTERIES AND LEGAL DECISION-MAKING 52 (1999) (discussing equality based on personhood); Lewis A. Kornhauser & Lawrence G. Sager, *Just Lotteries*, 27 SOC. SCI. INFO. 483, 499 (1988) (same).

70. *See, e.g.*, U.S. CONST. amends. XV, XIX (stating that the right of U.S. citizens to vote shall not be denied or abridged on account of race, color, or sex); 1958 CONST. art. 3 (Fr.) ("Le suffrage peut être direct ou indirect dans les conditions prévues par la Constitution. Il est toujours universel, égal et secret.").

71. Subject to possible variance in expected value among equal time-shares. *See* discussion *infra* Section II.C.1.d.

72. *See* CRAIG L. CARR, ON FAIRNESS 100 (2000) (explaining that rotation guarantees that each pursuer's want-claim is satisfied consistent with the claims of all others); GOODWIN, *supra* note 14, at 165 (explaining that rotation ensures equal enjoyment for everyone).

73. *See* Kornhauser & Sager, *supra* note 69, at 492 (explaining that lotteries may be justified only where "there is not enough of the good . . . [because] scarcity prevents a full and equal allocation of the good among the claimant pool").

McDowell case.[74] When equal shares cannot be allocated simultaneously due to divisibility constraints, rotation provides equal yet temporary enjoyment of the resource or shouldering of the burden. In principle, however, rotation may be justified even if the resource or burden is reasonably divisible. Under an assumption of divisibility, the question is whether temporary enjoyment of the entire resource furthers the allocation's fairness more than permanent enjoyment of a part of it. If, for example, a rotational scheme entails relatively high variance in expected value of equal-time shares,[75] simple rotation may not secure equality, so physical division will be preferable.[76] High variance may result from the risks of harm to the resource, diminishing capacity to utilize it, untimely transfers, etc. On the other hand, if the variance in pursuers' capacity to utilize physical parts of the resource is greater than the variance in expected value of time-shares in the entire resource, rotation may be fairer.[77]

We now turn to the case of a heterogeneous group of pursuers, namely one in which relevant interpersonal differences exist. In this type of case, the preliminary application of a substantive criterion leads to the conclusion that people with legitimate claims are not equally deserving. The principle of distributive justice requires that their shares be proportional to the relative strength of their claims. The idea of proportionality is entrenched in Aristotelian political theory[78] and also resonates in common perceptions of justice.[79] Support for equal shares is limited to cases of no relevant differences. Essentially, the principle applicable to homogeneous groups ("treat equals equally") is merely a special case of the distributive principle of proportionality, because where people are equal proportionality mandates equal shares.

Rotation can be adapted to the requirement of proportionality when applied to heterogeneous groups: participants who deserve a greater share of the resource under the applicable substantive criterion can enjoy the resource for longer periods of time.[80] One factor

74. *See In re* Estate of McDowell, 345 N.Y.S.2d 828, 830 (N.Y. Sur. Ct 1973); *see also* Hanoch Dagan & Michael A. Heller, *The Liberal Commons*, 110 YALE L.J. 549, 607, 617 (2001) (explaining in the context of partition that "[p]hysical division often proves impossible for a minority of the commoners or significantly diminishes the value of their shares").

75. Variance measures how far a set of numbers is spread out. In our case, the variance in share-value is a statistical measure for the level of inequality.

76. To some extent, such risks might be taken into account in designing the rotational scheme, so that participants under greater risks would receive larger time-shares. But this would probably make the process very costly.

77. Rotation may also have fairness-oriented advantages that physical division lacks. *See* discussion *infra* Section I.C.2.

78. ARISTOTLE, THE NICOMACHEAN ETHICS 85 (David Ross trans., rev. ed. 2009).

79. For example, survey studies uniformly show that people do not support equal distribution of income. Konow, *supra* note 43, at 1194-95.

80. *See* Daniel J.H. Greenwood, *Beyond the Counter-Majoritarian Difficulty: Judicial Decision-Making in a Polynomic World*, 53 RUTGERS L. REV. 781, 806 (2001) ("[I]n any

which may affect participants' share in a proportional rotation scheme is their relative contribution to the maintenance and development of the resource.[81] To the extent that the efforts exerted by rotation participants vary, it may be justified to set each participant's time-share in accordance with his or her efforts in maintaining the resource for the common benefit.

The idea of proportional rotation as a means of securing distributive justice may be applied with an interesting twist in the realm of political decision-making. The required modification concerns the participants in the allocation: to secure equal treatment to equal individuals, power is not rotated among the individuals but among the collectives to which they belong. The fairness of the simple majority rule rests on the assumption that it gives each voter an equal opportunity to influence the outcome of the decision-making process.[82] This is possible only if there is no fixed majority which makes the call on every issue, but shifting majorities, so that "the losers at one time or on one issue join with others and become part of the governing coalition at another time or on another issue."[83] However, in a polity divided into a permanent majority and a permanent minority, the majority rule gives each voter an equal opportunity only in the abstract, and does not truly respect the equality of voters.[84] In such a polity, members of the minority have no opportunity whatsoever to influence collective outcomes.[85] Lani Guinier has proposed that the permanent majority and the permanent minority take turns in making

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common enterprise when decisions cannot be made unanimously, fairness and equal consideration . . . seem to call for an allocation based on something like proportional sharing or taking turns . . . everyone comes out with some roughly similar proportion of their needs and desires fulfilled."); Ostrom & Gardner, *supra* note 31, at 100 (explaining proportional rotation). Of course, participants in a rotational scheme must have legitimate (though not equally strong) claims to the resource. Where a dispute arises, and one or more of the pursuers do not have legitimate claims (as in the case of a clear-cut property dispute), only those with legitimate claims may obtain the resource, even temporarily.

81. This ethical principle is somewhat related to John Locke's theory of property, whereby entitlement derives from labor. JOHN LOCKE, TWO TREATISES OF GOVERNMENT 159-76 (5th ed. London, A. Bettesworth 1728).

82. Richard Briffault, *Lani Guinier and the Dilemmas of American Democracy*, 95 COLUM. L. REV. 418, 453 (1995) (reviewing GUINIER, *supra* note 17).

83. GUINIER, *supra* note 17, at 5.

84. Briffault, *supra* note 82, at 453-54; *see* Brian Barry, *Is Democracy Special?*, *in* PHILOSOPHY, POLITICS, AND SOCIETY 155, 179 (Peter Laslett & James Fishkin eds., 1979) (discussing "a society [which] approximates to the model of a monolithic majority bloc facing a minority which is always on the losing side").

85. GUINIER, *supra* note 17, at 4 (explaining that the members of the minority have no chance ever to be in the majority, and that the problem is not that the majority prevails on particular issues, but rather that the majority can prevail on every issue); Lani Guinier, Keynote Address, 25 U. TOL. L. REV. 875, 879-80 (1995) ("[S]ometimes the majority functions as a fixed group that seems to rule, at least from the perspective of the minority, by ignoring the minority."); *see also* Barry, *supra* note 84, at 188 (stating that the majority rule tends to "produce outcomes that are highly prejudicial to the interests of the minority group"); Briffault, *supra* note 82, at 454 (discussing Guinier's thesis).

collective decisions.[86] The proposed method is a proportional-share, not an equal-share, rotation as it "gives those with the most support more turns."[87] By taking turns in political decision-making, the whole community will be represented over time, though not at every point in time, which brings us closer to "democratic fair play."[88]

A caveat is due at this point. Very often participants differ in relevant respects, but distinguishing them is impractical or impossible, so simple rotation might still be defensible on egalitarian grounds. This may happen in four types of cases. First, the allocator may be unable to know whether or not candidates have a relevant characteristic, meet a certain requirement, etc.[89] Second, the allocator may know that participants differ in relevant respects, but be unable to determine who is more worthy overall, namely when all qualities are taken into account, because the relevant qualities are incommensurable.[90] This conceptual impossibility cannot be overcome simply by exerting more effort. Take, for example, layoffs in a system that aims to respect both seniority and affirmative action. The allocator may be unable to compare people through an aggregate of the two qualities.[91] Third, the differences between participants may be too small for a human decision-maker to evaluate credibly.[92] This impossibility derives from the limits of human perceptiveness. Fourth, the differ-

86. GUINIER, *supra* note 17 *passim*.

87. *Id.* at 6; *see also* Briffault, *supra* note 82, at 452, 454 (explaining that the minority would presumably be entitled to a percentage of "turns" roughly comparable to its proportion of the population).

88. GUINIER, *supra* note 17, at 6; *see also* Paige Scott, Book Note, 18 HARV. WOMEN'S L.J. 317, 317 (1995) (reviewing GUINIER, *supra* note 17) (explaining that Guinier's standard of fundamental fairness requires that every contestant have an equal chance of winning each contest). The idea that the minority should be given an opportunity to prevail in some cases, depending on its proportion of the population, is akin to Akhil Amar's proposal to choose the winner in an electoral district by "a lottery of the ballots cast." Akhil Reed Amar, Note, *Choosing Representatives by Lottery Voting*, 93 YALE L.J. 1283, 1283 (1984); *accord id.* at 1290 (discussing the use of lotteries to select leaders). In more recent writings, Amar explained that "turn taking" might achieve the same goal. Akhil Reed Amar, *Lottery Voting: A Thought Experiment*, 1995 U. CHI. LEGAL F. 193, 202-03 (1995) (endorsing "the idea that the candidate of a minority party in a district might sometimes be the representative of that district. . . . That's a good thing for people to get used to—thinking that sometimes you should have a system of turn taking, with 'losers' taking their turn at the helm, too.").

89. *Cf.* Felix Oberholzer-Gee et al., *Fairness and Competence in Democratic Decisions*, 91 PUB. CHOICE 89, 96 (1997) (discussing inspection of baggage at the border, where only a given portion of all passengers can be inspected, and it is impossible to know, prior to selecting whom to inspect, who violates the law or poses a risk; advocating randomization, as rotation is irrelevant).

90. *See* ELSTER, *supra* note 68, at 109 (discussing this case); Adam M. Samaha, *Randomization in Adjudication*, 51 WM. & MARY L. REV. 1, 20 (2009) ("[A] decision maker might be unable to rank . . . options [which] differ along sufficiently different dimensions.").

91. *See* Hank Greely, Comment, *The Equality of Allocation by Lot*, 12 HARV. C.R.-C.L. L. REV. 113, 123-25 (1977) (discussing this case).

92. *See* ELSTER, *supra* note 68, at 74 ("[W]e would often find it impossible in practice to carry out finely grained comparisons of needs.").

ences between participants may be so small that evaluating them becomes too costly in terms of time, effort, or wealth.[93]

In the first three cases, the allocator is unable to determine relative worthiness under substantive criteria (such as need or merit). Therefore, the law may consider all candidates normatively equal, making simple rotation a fair allocation method. With respect to the fourth case (differentiation is too costly), we admittedly mix the egalitarian argument with efficiency, realizing that the benefits in terms of fairness of a fine-tuned application of substantive allocation criteria are too small to justify such a significant waste of resources. This is an efficiency-based constraint on the margin of fairness.

b. Preconditions for Application

The fairness case for a rotation-based solution to an allocative problem is not always compelling. To be justifiable and feasible, several conditions must be met. First, rotation aims to solve a divisibility problem. Thus, the allocated resource should not be reasonably divisible. If it is reasonably divisible into distinct shares that can be used simultaneously (each by a different pursuer), rotation may become a second-best solution, unless for some reason temporary enjoyment of the entire resource enhances the allocation's fairness more than permanent enjoyment of parts of it.[94] If there is neither need nor justification for a temporal division, the best allocation method, namely allocating equal permanent shares, should be applied. We use the word "reasonably" deliberately, because an indivisibility problem arises not only when the resource or burden cannot be divided at all, but also when its division is possible but unreasonable. This may happen when division significantly diminishes the aggregate worth of the allocated object,[95] or when it involves very high administrative and transaction costs.[96]

Second, rotation hinges on temporal divisibility, so if this form of division is also impossible or unwarranted, rotation becomes equally impossible or unwarranted.[97] An example of impossibility is a decision concerning the identity of the person who is to embark on a one-off hazardous mission.[98] This burden is neither "physically" nor temporally divisible, making rotation an irrelevant tool. As in the case of

93. *See id.* at 75 ("Costs of decision might make it pointless to use very fine tuned methods of screening . . . ."); *id.* at 107 ("The costs of fine-tuned screening . . . may be prohibitively high . . . ."); Samaha, *supra* note 90, at 20 ("Key information can be too costly to be worth acquiring or impossible to obtain . . . .").

94. *See* discussion *supra* Section II.C.1.a.

95. *See* Kuperman, *supra* note 5, at 277-78 (discussing reduction in value).

96. *See id.* at 278 (discussing administrative and transaction costs).

97. *See* GOODWIN, *supra* note 14, at 166.

98. *Id.* at 149 (discussing the one-off hazardous mission as an example of a non-rotatable burden).

physical divisibility, undesirability of temporal division arises when such division significantly diminishes the aggregate net worth of the allocated object.[99] In some contexts, the reduction is caused by breaking down the use into discrete time slots. Assume, for example, that the number of those fit for military service substantially exceeds the required quota of draftees. The law can require conscription of only some of those fit for service, or the conscription of all of them for much shorter periods of time. In the latter case, soldiers may be discharged before being trained, or before providing meaningful service. In other contexts, the reduction is caused by the transfer itself. A good example is the allocation of organs for transplantation (e.g., kidneys).[100] An organ cannot be reasonably used by different recipients sequentially. While it is theoretically possible to transfer the organ from one recipient to another after a certain period of time, this generates unreasonable risk to the organ and to the patients.[101] A child up for adoption cannot be reasonably placed with different families sequentially, because such a system harms the child as well as the attached adoptive parents.

Sometimes temporal division is not wholly impossible or unreasonable, but a "reasonable" division does not generate sufficient shares to go round, and any further division is impossible or unreasonable.[102] Put differently, if despite a reasonable temporal division, the number of eligible pursuers is still larger than the available reasonably sized time-sensitive units, we cannot allocate the resource fairly among all deserving pursuers. Dividing it further to accommodate all pursuers will be unreasonable. For example, if we allocate a small parcel of land among numerous pursuers by rota, none will be able to utilize it. Of course, we can use another method to decide which of the deserving pursuers will obtain a time-share. Selection may be based, for example, on a market mechanism (like an auction) or on egalitarian methods, like lotteries or queues. Either way, the fair outcome that rotation aims to secure will not be obtained.[103]

Third, rotation is necessary only where the physically indivisible resource (or burden) must be used (or borne) exclusively at any given time. If the resource (or burden) can be reasonably used (or borne) by all participants simultaneously, in common, there is no need to use (or bear) it sequentially.[104] For example, at most times, Central Park

99. *See* discussion *infra* Section III.B (discussing the impact of sharing on resource value from an efficiency perspective).

100. *See* YOUNG, *supra* note 10, at 14 (discussing organ transplantation).

101. Again, the reduction in the aggregate net worth of the allocated object also has efficiency implications.

102. *See* GOODWIN, *supra* note 14, at 165 (explaining that the resource must be sufficiently "plentiful," so that all pursuers can have a share).

103. For a comparison of rotation to other egalitarian allocation methods, see discussion *infra* Section II.C.1.c.

104. *See* GOODWIN, *supra* note 14, at 166.

can be reasonably enjoyed by all those willing and able to visit it. But even if simultaneous use is feasible, we should determine whether or not it generates a fairer outcome than rotation in the particular context. Simultaneous use, like rotation, affords roughly equal treatment. If the variance in user-value in the case of simultaneous use is smaller than the variance in the case of sequential use (rotation), the former is preferable from a fairness perspective, and vice versa.[105] Again, we use the word "reasonably" because simultaneous use may sometimes be impossible, and sometimes merely unwarranted.[106]

c. Comparison with Alternative Egalitarian Methods

Rotation, when properly applied, has two fundamental characteristics. First, it is an egalitarian method, affording equal treatment to equals, and proportional treatment to non-equals. Second, it aims to ensure distributive equality by resolving divisibility problems, rather than mere procedural equality which may lead to questionable outcomes. Still, rotation is neither the sole egalitarian allocation method nor the only one which aims to resolve divisibility problems. To assess its potential use, it must be compared with competing methods—firstly egalitarian methods which aim to accommodate all legitimate claims by resolving divisibility problems (conversion and allotment), and secondly egalitarian methods committed primarily to a fair procedure (lotteries and queues).

Three principal egalitarian methods are committed to *distributive justice*, namely accommodating all legitimate claims to a physically indivisible resource: rotation, conversion, and allotment (or compensation).[107] Rotation insists on dividing the actual resource or burden by substituting temporal division for physical division. Conversion replaces the physically indivisible resource or burden with a divisible one and allocates the latter.[108] A well-known form of conversion is the partition sale, namely the sale of a jointly-owned property, with the proceeds distributed among the disputing co-owners.[109] For example, if a valuable painting is bequeathed to several heirs, it can be sold (that is, exchanged for money) with the proceeds split among the

105. For a definition of "variance," see *supra* note 75.

106. Without proper regulation, simultaneous use of a common resource may result in its depletion. However, this problem may also arise in the case of rotation. *See* discussion *infra* Section II.C.1.d (discussing the tragedy of the commons).

107. *See* YOUNG, *supra* note 10, at 13.

108. *Id.*

109. *See* Dagan & Heller, *supra* note 74, at 607 ("Despite the heirs' request, and the law's nominal preference for partition in kind, courts usually order a partition sale . . . ."); *id.* at 617 ("In most cases now, partition is by sale, with the proceeds distributed pro rata according to ownership shares.").

heirs.[110] Allotment (or compensation) combines allocation of the actual resource or burden with conversion: one or more of the eligible pursuers obtain the actual resource and then compensate the others for their lost shares.[111] In the case of a burden, the ultimate bearers of the burden are compensated by the non-bearers.[112] A prominent example is a buy-sell agreement (also referred to as a "buy-me-buy-you" or a buyout agreement), whereby one of the co-owners of a specific property or business enterprise buys out the others' shares where the co-ownership needs to be dissolved.[113]

The relative weakness of conversion is that the market value, which determines the extent of the proceeds, may be much less than participants' subjective evaluations, as the rocking chair case in the Introduction demonstrates. Rotation enables each pursuer to capture a much greater proportion of the subjective value of his or her respective share. This outcome is fairer because participants do not obtain something considerably less valuable than what they had a legitimate claim to.[114] By contrast, if the resource's market value is equal to or greater than its subjective value, conversion seems preferable. Additionally, conversion enables a speedy and permanent—hence more certain—allocation. These advantages, clearly significant from an efficiency perspective,[115] are also relevant from a fairness perspective, because uncertainties arising from prolongation and transfers increase the variance in share value and undermine equality.

The relative weakness of allotment (compensation) is that it depends on the ability and willingness of one or more of the pursuers to acquire the undivided or insufficiently divided resource and to compensate the others for their loss.[116] When not enough pursuers are willing and able to buy the available units, a compensation scheme will fail, whereas rotation remains practicable. Then again, as in the case of conversion, compensation provides a quick and final resolution, whereas rotation maintains uncertainties and entails continuing enforcement.

Next, two principal egalitarian methods are committed to *procedural justice*, namely equal treatment in the allocation process, ra-

110. *See, e.g.*, Petrashek v. Petrashek, 440 N.W.2d 220, 223 (Neb. 1989) (discussing the division of the family home in the case of a divorce); Criss v. Criss, 28 W. Va. 388, 389 (1886) (discussing the division of land between the owner's heirs).

111. YOUNG, *supra* note 10, at 21.

112. *See id.*

113. *See, e.g.*, María-Angeles de Frutos & Thomas Kittsteiner, *Efficient Partnership Dissolution Under Buy-Sell Clauses*, 39 RAND J. ECON. 184, 184 (2008) (explaining that this method is used for dissolving malfunctioning commercial partnerships).

114. Provided that the preconditions explained in Section II.C.1.b, *infra*, are met.

115. In addition, unlike rotation, conversion does not entail a costly long-term enforcement mechanism.

116. Interestingly, rotation may in some cases facilitate a voluntary transfer of all shares to one pursuer. *See infra* notes 255-56 and accompanying text.

ther than distributive (outcome-oriented) justice: lotteries and queues. Lotteries are a borderline method. Unlike rotation, conversion, or compensation, they are not committed to roughly equal shares ex post; but, they are committed to equal opportunities ex ante.[117] In other words, something is distributed justly, but it is the chance of obtaining the resource (or bearing the burden), not the resource (or burden) itself. A queue is an allocation method in which resources or burdens are allocated to interested parties in their order of entry into an actual or a virtual line.[118]

The advantage of rotation over lotteries has already been implied. Rotation, as opposed to lotteries, does not generate tension between ex ante and ex post fairness,[119] that is, between procedural justice and distributive justice. Lotteries do not guarantee that everyone's legitimate claim is honored.[120] True, the idea that providing equal chance satisfies the requirement of equality is well established. But it may be challenged on the grounds that the main (though not the only) determinant of an allocation method's fairness is the outcome and that a person who acquires a non-materialized chance ultimately acquires nothing. David Wasserman compellingly observed that "the value conferred by the probabilistic shares in a lottery is shared only briefly before passing to a single claimant."[121] To the extent that one endorses this view,[122] rotation—which secures both procedural and distributive justice—is preferable in terms of fairness to lotteries, which afford only equal opportunities and not equal shares.[123]

However, in some cases lotteries may be preferable to rotation from a fairness perspective.[124] First, as explained above, rotation hinges on temporal divisibility, so if this form of division is impossi-

117. *See* YOUNG, *supra* note 10, at 20-21 (discussing lotteries).

118. *See* Perry & Zarsky, *Queues*, *supra* note 49, at 1596 (explaining the "first come, first served" rule, also known in queuing theory as the "first in, first out" (FIFO) principle).

119. YOUNG, *supra* note 10, at 21; *see also* Konow, *supra* note 43, at 1230 (citing YOUNG, *supra* note 10).

120. CARR, *supra* note 72, at 100-01.

121. David Wasserman, *Let Them Eat Chances: Probability and Distributive Justice*, 12 ECON. & PHIL. 29, 44 (1996). Wasserman explains that "hungry claimants [cannot] actually eat chances." *Id.* at 47.

122. One may argue that an opportunity in itself has value, as the purchase of lottery tickets demonstrates. Still, this value is unlikely to match the value of an actual share of the resource. Another possible argument is that, theoretically, a consistent use of lotteries for all allocations over time will result in equal distribution of benefits and burdens. Put differently, if all resources and burdens are allocated randomly, people are expected to end up with an equal material share in the long run. However, consistent use of lotteries for all allocations is not only unlikely, but also unwarranted, because in many cases other allocation methods are more appropriate.

123. *See* Konow, *supra* note 43, at 1230 ("[Lotteries] can be seen as a second best solution . . . ."). Note, however, that lotteries may still be superior to rotation in terms of efficiency.

124. This does not mean that in such circumstances a lottery must be applied. Other considerations may support selecting a different method.

ble or unwarranted, rotation becomes impossible or unwarranted as well. In such cases, an alternative method must be used to select those who receive the resource or bear the burden, and one of the most promising egalitarian methods is the lottery.[125] For example, in "allocating" organs to patients and children to adoptive parents, rotation is theoretically possible but highly problematic.[126] Insofar as the candidates for transplantation or adoption are equal in all relevant respects, a lottery may be preferable. Sometimes, though, rotation of the resource or the burden is unreasonable, but creative rotation-based solutions may be fairer than lotteries. For example, a decision concerning layoffs cannot be made on a rotational basis because temporal division of employee discharge is unreasonable. But rotation-based alternatives to laying off may be developed. Employees may give up some of their working days or overtime on a rotational basis, enabling their peers to keep their jobs. In other words, a certain amount of paid working hours is rotated among employees. This may be regarded a fairer outcome than that obtained through a layoff lottery in the sense that no employee will lose his or her job.

Second, rotation is possible only if temporal division can accommodate all eligible pursuers.[127] It will usually work only with respect to small groups,[128] or if the resource's nature allows division into a sufficiently large number of time-based units. Where the number of eligible pursuers exceeds the available units, an alternative allocation method must be used to select the "winners" from the pool of candidates. The lottery, once again, is a promising egalitarian alternative.[129]

After its comparison with lotteries, the advantage of rotation over queues may seem self-evident. Even without considering possible unfairness in the process, queues may generate unfair outcomes, because they systematically favor the speedy.[130] Sometimes the tardy cannot enjoy the resource at all, and sometimes they obtain units of

125. *See* GOODWIN, *supra* note 14, at 149 (explaining that many goods and evils cannot be rotated, and that rotation "lacks the scope of the lottery, which can in principle fairly distribute any kind of good").

126. *See supra* notes 101-02 and accompanying text.

127. *See* GOODWIN, *supra* note 14, at 165 (Rotation may replace the lottery "where there is enough of one good for everyone to sample it at least once during her lifetime, and where there is an unavoidable evil or burden which can be divided and distributed equally over time.").

128. *See id.* at 158 (explaining that in small groups, rotation is preferable and is, in fact, "the most just way of distributing" the resource).

129. *See id.* at 157, 159, 165, 166 ("[B]ecause there are usually substantially fewer political and public posts than there are people . . . it is impossible that everyone should participate during her lifetime. . . . [Lottery has an advantage] where there were fewer political goods than eligible citizens. . . . The rotation of plentiful, but not abundant, goods would ensure equal enjoyment for everyone, whereas scarce goods can be distributed only by lottery . . . . Many goods are too scarce [for rotation] . . . . Hence . . . there are distributive functions which only a lottery can perform.").

130. CARR, *supra* note 72, at 100.

lesser quality or simply receive their shares later.[131] If time of entry is not correlated with morally relevant characteristics, the differentiation among participants in a queue-based allocation is unfair in the distributive sense, and therefore inferior to rotation.[132]

We have argued elsewhere that in some contexts a queue-based allocation method can be justified as an attempt to maintain a rough correlation between one's investment and reward.[133] Securing a temporal advantage entails an extra burden, consisting of any effort and cost needed to obtain and maintain the temporal advantage. Now, those who "work" harder deserve more.[134] Thus, all other things being equal, a person who incurs an additional burden to secure prior entry into the queue and to maintain this position deserves a greater benefit, such as preferential service.[135] One who arrives later has invested less, hence deserves less in return. In these cases, the queue is fair in the procedural as well as the distributive sense.[136]

However, the principle of just desert requires more than mere correlation between two ordinal scales (effort and reward). It also requires rough proportionality between the magnitude of each person's reward and the extent of that person's effort.[137] For example, assume that the government allocates a few parcels of land in a prime location using a queue. The earlier one submits an application, the better the parcel one acquires. Given the finiteness of the allocated resource, latecomers may be left with nothing. Here the outcome cannot be justified in terms of desert. True, those who submit their application earlier make an extra effort, but the marginal reward is out of proportion to that extra effort. The fact that *A* fills out and submits a form several minutes before *B*, and that *B* submits a form several minutes before *C*, cannot justify the allocation of a superior parcel to *A*, and possibly nothing to *C*. In such cases, the queue does not maintain proportionality between the magnitude of one's reward and the extent of one's effort, and cannot be justified in terms of just desert.

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131. *See* Perry & Zarsky, *Queues*, *supra* note 49, at 1600-01 (discussing the possible effects of using a FIFO-based method on participants).

132. For a detailed analysis and discussion of the possible correlation between time of entry and morally relevant characteristics, see *id.* at 1624-25.

133. *Id.* at 1614-20.

134. *See* David Miller, *Recent Theories of Social Justice*, 21 BRIT. J. POL. SCI. 371, 379 (1991) (discussing Sher's view that "those who work hard to achieve a particular goal deserve to succeed").

135. *See* Leon Mann, *Queue Culture: The Waiting Line as a Social System*, 75 AM. J. SOC. 340, 346 ("[I]f a person is willing to invest large amounts of time and suffering in an activity, people who believe there should be an appropriate fit between effort and reward will respect his right to priority."). This normative argument is consistent with common perceptions of fairness. *See supra* note 59 and accompanying text.

136. *See, e.g.*, Peter H. Schuck, *The Worst Should Go First: Deferral Registries in Asbestos Litigation*, 15 HARV. J.L. & PUB. POL'Y 541, 561 (1992) ("Temporal priority . . . rewards those who take the trouble and initiative to assert their claims with dispatch.").

137. *See* John Kleinig, *The Concept of Desert*, 8 AM. PHIL. Q. 71, 77 (1971) (explaining that desert considerations determine the magnitude of the reward or the punishment).

Arguably, the queue may be fair in the distributive sense when used to allocate benefits of relatively limited and not significantly varied value, such as abundant resources, scarce resources that require a great deal of effort to utilize,[138] or relatively small portions of scarce and immediately usable resources. In such cases, the differences between the rewards to different people in the line are small and may be justified by differences in times of entry. But when significant portions of scarce and immediately usable resources are allocated, the queue cannot be defended in terms of distributive justice. So where the law addresses allocations of usable, scarce resources, rotation may be superior to queues from a distributive justice perspective.[139]

In sum, rotation is inappropriate if temporal division is impossible, unwarranted, or if it cannot generate enough shares to go round. When distributive justice cannot be achieved due to divisibility issues, fairness-driven allocators should focus on procedural justice, and queues, like lotteries, seem an appropriate egalitarian alternative. Moreover, while queues seem inferior to rotation when they unfairly differentiate equals, rotation also differentiates equals to some (more limited) extent by allocating the resource or burden to participants at different times.[140]

d. General Practical Problems

The use of rotation may raise several practical problems from a fairness perspective. First, in most cases, sharing the use of a resource can substantially change its condition over time.[141] This problem typically arises in the case of common-pool resources, such as fisheries or pastures. But it may occur with the allocation of most types of resources by rotation, the exceptions being those not diminishable by use, such as electromagnetic spectrum or solar energy.[142] The problem usually involves two related aspects: excessive use and insufficient maintenance and development. With respect to use, the portion that one person appropriates to oneself on one's turn may not

138. *See* Lawrence Berger, *An Analysis of the Doctrine That "First in Time Is First in Right,"* 64 NEB. L. REV. 349, 377 (1985) (discussing homestead laws in the nineteenth century, as an example of abundant resources, and water rights, as an example of scarce resources that require efforts to utilize).

139. Because a queue may be fair in the distributive sense when used to allocate benefits of relatively limited and not significantly varied value, it can be used to determine user-order in rotation-based schemes.

140. Theoretically, time-shares can be adjusted to reflect time preferences, but this solution may be too costly to implement.

141. *See* YOUNG, *supra* note 10, at 21 (explaining that use may change the resource).

142. *See* Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273, 298 (2004) (discussing forms of renewable sources); *see also* BALAND & PLATTEAU, *supra* note 29, at 9 (discussing solar energy).

be available to others. For example, fishermen who harvest a fishery before others have an incentive to do so beyond the sustainable level because they derive all the benefit from the additional fish while sharing the cost of depletion with subsequent users. Thus, rotational use of the fishery may push it to the brink of extinction.[143] With respect to maintenance, people have no incentive to maintain and develop a resource allocated by rotation, because any profit accruing from their investment is shared by subsequent users. Empirical studies seem to support these theoretical predictions, demonstrating that in the absence of state intervention or sufficiently strong social norms, common-pool resources are overused and underprovided.[144] The problem, known in the context of common-pool resources as "the tragedy of the commons," may arise whenever the use of a resource is shared, simultaneously or sequentially.

While the potential impact of sharing on resources has been studied mostly by economists, it is highly relevant from a fairness perspective in the case of allocation by rota. Excessive use and insufficient maintenance by earlier users affect the quantity and quality available for subsequent users and may therefore undermine the attempt to allocate equal shares to equals (or proportional shares to non-equals). The generalized tragedy of the commons can be addressed through some kind of regulation, but this may render the allocation method too costly to implement.[145] Sometimes, however, the problem may be resolved without legal intervention. Specifically, in repeated-sequence rotations, participants have a stronger incentive to treat their peers fairly, given the likelihood of retaliation.[146]

Second, temporal division does not serve as a defensible basis for rotation where the value of time-shares varies due to variation in participants' utilization capacity, or to changes in the resource itself caused by seasonal fluctuations or accidental events. Consider, for example, the allocation of fishing rights in a particular fishery through time-based rotation. Each fisherman obtains fishing rights for an equal period of time. Some fishermen may catch less than others because of differences in fishing capacity or because of changes caused to the fishery by seasonal climate changes or oil pollution. In such cases, rotation may be quota-based rather than time-based.

Third, even if the resource's condition is static over time, differences in time-of-use may undermine the equality of the shares. As Jon Elster observed, rotation may seem similar to equal physical division of a cake; yet "because it often matters when a task is to be

143. *See* Kuperman, *supra* note 5, at 282 (discussing this problem); Ostrom & Gardner, *supra* note 31, at 93-94 (same).

144. *See* Ostrom & Gardner, *supra* note 31, at 95 (summarizing the literature).

145. *See* discussion *infra* Section III.D.3.c.

146. *See* discussion *infra* Sections II.C.2.a, III.D.3.a.

performed, whereas it does not matter who gets which of several identical pieces of cake, the two mechanisms are quite different."[147] People tend to value current possession more than they value future possession of the same property.[148] Similarly, they may prefer a future burden to an immediate one. From an economic perspective, the more immediate the initial use, the higher its discounted value. So participants who receive equal-time shares do not get exactly equal shares. Theoretically, time-shares can be adjusted to reflect time-preferences, but this might be a very complicated solution, and therefore impractical.[149] Additionally, a repeated-sequence rotation with shorter turns may alleviate this concern, although it may raise other problems, mostly from an efficiency perspective.[150]

Fourth, rotation is always accompanied by other allocation methods and criteria, which should not jeopardize the system's overall fairness. These methods may be required at three stages. To begin with, rotation is generally preceded by a preliminary selection of participants from among interested or potentially interested parties ("pre-selection").[151] Selection may be based on substantive evaluative criteria, such as need, merit, and willingness to pay,[152] or on a non-evaluative process, such as a lottery or a queue. To maintain the allocation method's fairness, the determination of eligibility to participate in the rotation must also be defended in terms of fairness. Moreover, if participants are unequal, and the goal is proportional rather than equal shares, substantive criteria must be used to determine each participant's fair share.[153] Lastly, we explained that differences in time-of-use may cause share-value variance. This variance, which may be large, highlights the importance of user ordering. A rotational scheme requires ordering, and an ordering is in itself an allocation—of time slots among eligible parties—which requires a different allo-

147. ELSTER, *supra* note 68, at 72.

148. Kuperman, *supra* note 5, at 282.

149. *See infra* note 211 and accompanying text.

150. *See, e.g.*, discussion *infra* Section III.D.3.

151. *Cf.* ELSTER, *supra* note 68, at 67-68 ("I know of no instance of social lotteries without some preselection or postselection [sic] scrutiny.").

152. *See* discussion *supra* Section II.C.1.a (discussing simple rotation).

153. *See* YOUNG, *supra* note 10, at 14 (The question remains "how much is each claimant entitled to?"); *see also* discussion *supra* Section II.C.1.a (discussing proportional rotation).

cation method. To maintain the egalitarian nature of the scheme, lotteries[154] or queues[155] can be used to match each participant with a time slot.[156]

Fifth, rotation, like all other allocation methods, may be susceptible to wealth-based gaming and circumvention, which undermine its overall fairness. Ex post, the well-off can purchase the resource at a higher price from speculators or from others who acquired the resource in the primary allocation.[157] If it is important, for example on egalitarian grounds, to preserve the initial allocation, secondary market transactions should be prohibited. Ex ante, affluent pursuers may have more opportunities to meet the eligibility threshold in a simple rotation or to manipulate the variable affecting their shares in a proportional rotation.[158] For instance, in a rotational road-space rationing, wealthy drivers can purchase another car with a different last-digit on its license plate to circumvent the burden of city entry restrictions. If this phenomenon undermines the system's fairness, it ought to be prevented.

2. *Second-Order Fairness*

a. *Inter-Participant Fairness and Social Virtue*

In some cases, by applying rotation, the allocator not only treats pursuers fairly, but also encourages participants to treat each other fairly when using the resource or bearing the burden. This inter-participant behavior is a secondary fairness effect, following the primary fairness of the allocator's conduct, and may be subsumed under the rubric "reciprocity." This effect occurs when each user's conduct may have an impact on subsequent users, transpiring at the time of his or her use or following such use. The user has an incentive not to

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154. *See* BALAND & PLATTEAU, *supra* note 29, at 204 (discussing lottery-based ordering); ELSTER, *supra* note 9, at 72 (same); GOODWIN, *supra* note 14, at 179 (same). For example, in Republican Rome, lotteries were used to determine the order of rotation in political offices. ELSTER, *supra* note 68, at 72.

155. *See supra* note 138 and accompanying text.

156. At times, however, positions are established differently. For example, fishing spots in West Africa were allocated by rotation, and the order was set by the river's master. BALAND & PLATTEAU, *supra* note 29, at 204. Alternatively, the order can be set by a committee. *See* Ostrom & Gardner, *supra* note 31, at 105.

157. *Cf.* MICHAEL J. SANDEL, WHAT MONEY CAN'T BUY: THE MORAL LIMITS OF MARKETS 24-25 (2012) (discussing privileged classes' ability to circumvent queues); Mann, *supra* note 135, at 353 (same). For a discussion of secondary markets from an efficiency perspective, see discussion *infra* Section III.B.

158. This, too, is not unique to rotation. For instance, affluent pursuers may employ various ex ante strategies in queue-based allocations: they may use their resources to secure early entry, pay other queuers to cut in, employ agents to enter the queue and obtain the resource on their behalf, or hire people to serve as placeholders for a while. SANDEL, *supra* note 157, at 21-22; Felix Oberholzer-Gee, *A Market for Time: Fairness and Efficiency in Waiting Lines*, 59 KYKLOS 427 *passim* (2006); Barry Schwartz, *Waiting, Exchange, and Power: The Distribution of Time in Social Systems*, 79 AM. J. SOC. 841, 849 (1974).

act unfairly to others because those harmed by unfair conduct can reciprocate in their turn, whereas those treated fairly may follow the example: "In a reciprocal relationship, we trust others not because we have common ends, but because each of us holds the fate of others in our hands in a manner of tit-for-tat"; each user acts fairly to subsequent users "because soon the tables will be turned."[159] Presumably, this effect is weaker in one-off sequence rotations, because the incentive to treat one's peers fairly diminishes as the sequence of users moves forward and the likelihood of retaliation lessens. In repeated-sequence rotation, the incentive is better preserved, and it is strongest if the rotation has no predetermined ending point.[160]

This rationale is also applicable to the modified version of proportional rotation in the area of political decision-making. If power is allocated by rota between the permanent majority and the permanent minority, the former will be cautious not to use it unfairly. Put differently, rotation between the collectives does more than just let the minority enjoy some of the power from time to time. If the permanent majority is required to share power with the minority, it is incentivized to confer with the minority, consider its preferences, and compromise with it to some extent.[161] By promoting deliberation and compromise, rotation affects "not only the identity of the winners and losers of particular battles, but also the nature of the political process."[162] It creates "an institutional setting in which the majority is willing to listen to the minority and to seek its cooperation," hence a more democratic system of government.[163]

The incentive to act fairly to other participants in a rotational scheme may also have a tertiary effect, which we call "nourishing social virtue." A virtue is a dispositional property, that is, the inclination to act in a commendable manner.[164] A social virtue is the disposition to "seek the good of others as an end in itself, and in circumstances in which [it] is not required of us,"[165] and it demands "not only that the good of others be furthered, but that a cost be borne by the generous individual."[166] The related civic virtue is the disposition to engage in voluntary association and to promote common ends in so-

159. Helen Nissenbaum, *Securing Trust Online: Wisdom or Oxymoron?*, 81 B.U. L. REV. 635, 645 (2001); *see also* BARBARA GOODWIN, JUSTICE BY LOTTERY 127 (1st ed. 1992) (explaining that a person may use the resource fairly fearing retaliation by subsequent users for any abuse, or trying to set an example that others might follow).

160. *See also infra* notes 263-65 and accompanying text.

161. Briffault, *supra* note 82, at 455.

162. *Id.*

163. *Id.* at 464-65.

164. Yochai Benkler & Helen Nissenbaum, *Commons-Based Peer Production and Virtue*, 14 J. POL. PHIL. 394, 405 (2006).

165. LESTER H. HUNT, CHARACTER AND CULTURE 63 (1997).

166. Benkler & Nissenbaum, *supra* note 164, at 407.

cial cooperation.[167] Presumably, virtue is an acquired property, affected by our interactions with and observation of others. It is possible that a rotational system that induces inter-participant benevolence and cooperation may nourish social and civic virtues among participants. Although their behavior is initially self-serving, it may develop through practice into a general disposition that would manifest itself outside this particular system. Moreover, participants' behavior may also nourish social and civic virtues among other people observing and accepting the importance of benevolence and cooperation. Admittedly, these are purely theoretical predictions which call for empirical validation.

b. Social Justice

Less frequent secondary fairness effects may occur when allocating society's necessary but extremely unpleasant, dangerous, or disreputable burdens, such as perilous tasks or proximity to hazardous materials. Where bearing such burdens benefits society at large and causes unusual discomfort that no one truly desires to bear, one may contend that they should be disseminated and borne by all capable members. In a society that allocates such burdens through market mechanisms, the people who ultimately bear them are usually members of the lower classes. Thus, lower classes bear an unreasonably disproportionate share of the overall hardship. Rotation of extremely unpleasant tasks among all capable members of society sustains a form of social justice.

If the burden is not only unpleasant but also disreputable, market-based allocation methods will preserve the respective stigma. Rotation of the burden among all members of society may alleviate the stigma, because a person cannot be stigmatized for doing something that all people do. For example, if some essential occupations are considered disreputable, rotating them among all people may help ensure equal respect for all workers.[168]

III. EFFICIENCY

A. Overview

This Part examines several factors that must be considered when striving to establish the efficiency of rotation-based allocation methods. It begins by examining the impact of allocation via rotation on participants' utility after the allocation takes place (ex post) and on

167. *Id.* at 409.

168. *See* GOODWIN, *supra* note 14, at 161 (explaining that if all occupations are rotated they "achieve equal respect"); WALZER, *supra* note 31, at 174 (explaining that rotation of "hard work" may help de-stigmatize it).

their actions prior to the allocation (ex ante). Next, it explains how rotations might reduce or increase administrative costs. These are divided into several sub-categories related to unique concerns: setting up the rotation scheme, transferring the rotating resource among participants and monitoring the transfers, and administrating ongoing operations when needed. Finally, this Part examines positive and negative effects that rotation might have on the allocated resource, and on society at large.

B. Ex Post Effects

Allocation by rotation usually fails to place the resource in the hands of the party who can derive the most utility from it, especially when the pool of rotating users is heterogeneous. Instead, rotation-based allocations place the resource in the hands of several recipients. As these recipients presumably differ from each other, some will not be using the resource as efficiently as others. Therefore, on the face of it, allocation via rotation is inferior to other allocation models, such as bids, merit, need, or even queues,[169] from an efficiency perspective. The efficient option would be to allocate the resource to the person who can derive the greatest value from it. However, when participants have a similar ability to utilize the resource, or when ascertaining the differences among them is impossible or too costly, rotation might be preferable to an accurate application of a substantive allocation criterion.

The ex post inefficiencies could be substantially mitigated through secondary markets. In such markets, the optimal users can purchase the resource from those who value it less. The costs of secondary transactions must then be considered when examining rotations' overall efficiency.[170] Sometimes, of course, secondary markets will fail to place the resource in the hands of the most efficient user after a problematic initial allocation due to market failures,[171] thus entrenching the problem.[172] Moreover, elaborate multiple-object rotation (e.g., the rotation of fishing spots among fishermen in Sri Lankan fishing communities) often involves non-transferable rights, again rendering the mitigating effects of secondary markets irrele-

169. In some instances, a temporal advantage signals the importance an individual places on receiving the asset, just as willingness to pay might reflect such a preference. *See* Perry & Zarsky, *Queues*, *supra* note 49, 1624-26.

170. For further discussion of the impact rotation might have on information flow and on the efficiency of transactions between participants, see discussion *infra* Section III.C.2.

171. *See* PAUL MILGROM, PUTTING AUCTION THEORY TO WORK 21 (2004) (discussing possible secondary-market failures).

172. *See also* Perry & Zarsky, *Queues*, *supra* note 49, at 1629-30, 1653-55 (discussing this problems in the context of queues); Perry & Zarsky, *supra* note 38, at 1067-68 (discussing this problem in the context of lotteries).

vant.[173] Here we should balance the benefits and shortcomings of inalienability of rights in the rotated resource. On the one hand, alienability may enhance efficiency through secondary markets. On the other hand, alienability enables participants to exit the scheme at will, thus hindering the emergence of social norms and responsibilities characteristic of cohesive communities. Such norms promote efficiency by enabling self-rule, reducing various monitoring costs,[174] and limiting tendencies to engage in strategic behavior.[175]

Even when the participants' pool is homogeneous, rotation might affect the utility derived from the resource. Users frequently develop familiarity with the allocated resource and expertise in deriving benefits from it. Therefore, the marginal utility that a user will derive from the asset might increase over time and surpass that of a new user taking his or her place through rotation.

The impact of the expertise-based argument on the efficiency of rotations depends on the nature of the learning curve for using the asset involved, as well as the length of time allotted to each rotation participant. For instance, with repeated-sequence rotation, all participants will eventually reach a high level of expertise. In such cases, the difference between rotation and other allocation methods will be the lost utility that could have been enjoyed by an expert participant (exercising exclusive control in a non-rotating regime) during the time novice participants in an alternative rotation-based system were developing expertise in using the resource.

The "development-of-expertise" case against rotations has additional constraints. For instance, with multiple-object rotations involving several comparable resources, the development-of-expertise argument loses force. All participants are subject to a similar learning environment, and the rotation of the underlying resource need not matter. In addition, the argument fails to generate traction when efficient utilization does not require substantial expertise or is easily learned, [176] or where the necessary expertise has already been acquired.

Quite the contrary: in some instances rotation might even enhance expertise, and therefore welfare. This issue is best demonstrated in the context of labor allocation, where some firms allow or even require employees to rotate among positions, particularly non-specialized.[177] Having the opportunity to perform various tasks and

173. *Cf.* BALAND & PLATTEAU, *supra* note 29, at 171-72; Perry & Zarsky, *supra* note 38, at 1068 (discussing inalienability in the context of lotteries).

174. *See* discussion *infra* Section III.D.3.c.

175. *See supra* notes 143-44 and accompanying text.

176. *See* GOODWIN, *supra* note 14, at 200 (discussing this example).

177. *See id.* (discussing the benefits of rotation in the military and academia); *cf.* Dennis D. Hirsch, *Lean and Green? Environmental Law and Policy and the Flexible Production Economy*, 79 IND. L.J. 611, 622 & n.83 (2004) (citing MARTIN KENNEY & RICHARD FLORIDA,

interact with various environments, employees acquire deeper knowledge about the entire organization (or even a particular industry),[178] as well as tools to handle emergencies.[179] Rotation also facilitates the flow of information throughout the organization via the rotating employees.

Moreover, according to the law of diminishing marginal utility, spreading the use of a resource may actually enhance the aggregate utility derived from it. The satisfaction derived from consuming marginal items of a resource decreases, at times quite drastically, from a specific point.[180] Put differently, assuming limited variance in utility functions, the value of using a particular resource for an additional period of time may be lower for the current user than for a new user. Thus, allocating resources by rotation may enable optimizing outputs. Where the group of participants is homogeneous,[181] the utility of the resource for a new user in a given period of time might be greater than the marginal utility for a continuing user in the same period of time, so rotation will generate greater aggregate utility than exclusive use by one person.[182] This is more likely to occur if a resource is allocated to individuals for personal use only. If participants can utilize the resource through the labor of third parties, it makes little difference whether these third parties are employed by one exclusive user or by several rotating users. Similarly, under the same principle of diminishing marginal utility, the loss of utility for a new bearer of a burden in a given period of time might be smaller than the marginal loss of utility for a continuing bearer in the same period of time, assuming, once again, homogeneity of utility functions. Rotation will reduce the aggregate loss of utility compared with imposition of the burden on one person.[183] A related principle applies to labor: over time most types of work become irksome, leading employees to lower

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BEYOND MASS PRODUCTION: THE JAPANESE SYSTEM AND ITS TRANSFER TO THE UNITED STATES 38 (1993)) (discussing the advantages of using flexible production technologies, including non-specialized machines).

178. *See, e.g.*, Lin & Milhaupt, *supra* note 26, at 701, 707, 740-41 (discussing the Chinese practice of rotating executives (even CEOs) between state-owned firms and government positions).

179. *Id.*

180. *See* Gary Lawson, *Efficiency and Individualism*, 42 DUKE L.J. 53, 71 & n.57 (1992) (discussing diminishing marginal utility).

181. Homogeneity also denotes low variance in utility functions. *See id.* at 72 (arguing that the law of diminishing marginal utility cannot be used to compare different individuals, due to variance in utility functions).

182. This may explain why instead of selecting only a few priests and Levites to serve in the Temple, all were divided into twenty-four divisions serving in rotation. Rotation enabled all to share the special spiritual experience. *See* Jacob Liver & Daniel Sperber, *Mishmarot and Ma'amadot*, *in* 14 ENCYCLOPEDIA JUDAICA 317, 317-19 (Michael Berenbaum & Fred Skolnik eds., 2d ed. 2007).

183. *Cf.* Stephen R. Perry, *Tort Law*, *in* A COMPANION TO PHILOSOPHY OF LAW AND LEGAL THEORY 64, 76-77 (Dennis Patterson ed., 2d ed. 2010) ("The basic rationale for such loss-spreading is that it will have the effect, because of the diminishing marginal utility of

marginal performance. Tasks which generate substantial fatigue and agitation may be rotated among various people to maintain higher returns.[184]

Note that these principles are of limited force in the context of multiple-object rotations, where the allocated objects are similar. Here, the participants constantly move from one resource or burden to another, and each novel experience in the rotation scheme might be considered a continuation of the previous one, with a diminishing marginal utility along the way in the case of resources and an increasing marginal loss of utility in the case of burdens.

To strengthen this analysis, recall the "property as personhood" concept developed by Margaret Radin.[185] Radin famously argued that individuals require some control over resources and objects (as opposed to replaceable artifacts such as money) in the external environment, to achieve proper self-development and fulfillment.[186] Because having control over some forms of property is so valuable, providing control to as many individuals as possible through physical partition and temporal division (that is, rotation) will generate substantial benefits for these individuals. These will go far beyond the overall utility for a single owner of the undivided property.

However, the attempt to enhance personhood through mere temporal ownership might also have welfare-reducing implications. The individuals' eagerness to acquire property (and thus enhance personhood) might be manipulated. At least in the timesharing context, Robert Ellickson notes that marketing schemes might tap "into a buyer's anticipated delight in feeling that he owns . . . a dwelling unit in a prestigious location," when in fact the buyer's rights are limited, and the benefits quite slim. [187] Therefore, consumer protection measures might be necessary to supervise these specific timesharing arrangements.[188] When consumer problems are effectively solvable, rotation might prove efficient after all.

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money, of minimizing the overall social impact that a given loss will have . . . . Sometimes the overall social impact of a loss can similarly be decreased not by spreading it, but by taking it from a 'deep pocket.' ").

184. Consider, for example, the various forms of manual labor required in the Israeli kibbutz. Traditionally, these tasks have been rotated among all competent members. *See* Bell & Parchomovsky, *supra* note 27, at 529.

185. Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 *passim* (1982); *see also* Kuperman, *supra* note 5, at 281 (discussing this idea).

186. Radin, *supra* note 185, at 957-58.

187. Robert C. Ellickson, *Unpacking the Household: Informal Property Rights Around the Hearth*, 116 YALE L.J. 226, 293 n.252 (2006).

188. Note the abundance of specific consumer protection laws pertaining to timesharing. *See, e.g.*, Florida Vacation Plan and Timesharing Act, FLA. STAT. § 721.01-.32 (2015); North Carolina Time Share Act, N.C. GEN. STAT. § 93A-39 to 57 (2015); Patrick J. Rohan & Daniel A. Furlong, *Timesharing and Consumer Protection: A Precis for Attorneys*, 10 WM. MITCHELL L. REV. 13 *passim* (1984). For information on these laws in the European Union, see Directive 2008/122/EC, of the European Parliament and of the Council of 14

Of course, the "law of diminishing marginal utility" does not necessarily call for mandatory rotations. Allowing temporal division of property rights and transfers of time-shares[189] enables parties to bargain around the default property rights or allocation structures when they detect inefficiencies.[190] We acknowledge, therefore, that the law may at times endorse rotations by merely allowing, rather than mandating, them.[191] Optional temporal divisions may be applied when spatial and other forms of physical division cannot accommodate all pursuers who would derive greater utility than the marginal benefit of the fewer users to whom other methods would allocate the resource. According to this argument, timesharing arrangements, which allow for the slicing of property rights into relatively small temporal pieces, enhance the overall utility derived from each vacation unit and should be generally permitted by law.

Lastly, rotation might sometimes enhance the aggregate utility derived from participants' use of the resource by limiting the period of time in which a single individual controls the resource. Such a limit reduces the risks and costs to third parties associated with prolonged use. This issue is best demonstrated in the context of employment: in some sectors, extensively holding a specific position might generate higher risks of embezzlement and corruption.[192] Similarly, prolonged supply of goods or services by a specific entity might give rise to over-dependence between the provider and the recipients. This dynamic might lead to further complications later on, such as "vendor lock-in," enabling the specific provider to charge higher pric-

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Jan. 2009 on the Protection of Consumers in Respect of Certain Aspects of Timeshare, Long-term Holiday Product, Resale and Exchange Contracts, 2009 O.J. (L 33) 10. For a detailed discussion of the timesharing market, its history, growth, and negative image, see Amy M. Gregory, *Examining the Impact of Negative Attributes on Consumer Preference and Willingness to Pay in the Vacation Ownership Industry: A Conjoint Analysis*, J. TOURISM RES. & HOSPITALITY 2013, at 1.

189. *See* Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1372 (1993) (discussing the customization of "time blocks").

190. *See* Saul Levmore, *Variety and Uniformity in the Treatment of the Good-Faith Purchaser*, 16 J. LEGAL STUD. 43, 65 n.80 (1987) (explaining that the paucity of complex intermediate solutions in property law, as opposed to tort law, might indeed reflect the greater likelihood of such bargaining).

191. This is not trivial. For example, the law does not currently accommodate rotational property rights. It does not allow the owner of a timesharing right to receive a "fee simple" in the property. Co-ownership cannot be defined as one that is divided temporally. *See* Mary Lou Savage et al., *Time Share Regulation: The Wisconsin Model*, 77 MARQ. L. REV. 719, 725-26 (1994); *see also* JOSHUA WEISMAN, LAW OF PROPERTY—OWNERSHIP AND CONCURRENT OWNERSHIP 74-76 (1997) (Hebrew) (explaining this constraint). *But see* Abraham Bell & Gideon Parchomovsky, *Reconfiguring Property in Three Dimensions*, 75 U. CHI. L. REV. 1015, 1021 (2008) (discussing *McDowell* and noting that the court "invented" a resolution "oriented toward dominion through forced time-sharing").

192. *See* Klaus Abbink, *Staff Rotation: A Powerful Weapon Against Corruption?* (Univ. of Bonn SFB 303 Discussion Paper No. B-460, 1999), http://www.wiwi.uni-bonn.de/sfb303/papers/1999/b/bonnsfb460.pdf.

es and provide inferior goods or services.[193] These concerns have led to the implementation of rotation policies in various industries. For instance, some financial industries rotate employees, even—perhaps especially—those most gifted in doing their job, among clients and accounts.[194] Others limit the duration of crucial contractual agreements with suppliers, effectively employing rotation among suppliers or service providers.[195]

C. *Ex Ante Effects*

1. *Preparing for an Allocation*

Allocating resources by rota somewhat overrides the need to rank potential recipients.[196] By contrast, such ranking occurs whenever resources are allocated on the basis of skill, need, merit, willingness to pay, and even queues (but not in the case of allocation by lot). In anticipation of such ranking, prospective recipients may perform various actions to improve their position. These actions seem unnecessary when rotation is applied.[197]

In some instances, the change in ex ante behavior caused by the application of rotation instead of other allocation methods promotes efficiency. This is the case when actions taken in anticipation of other allocation schemes involve risks, costs, and possibly waste.[198] The relative advantage of rotation is apparent, particularly in comparison to allocation via first possession or a queue. To claim the resource there, individuals at times engage in risky and costly races. For instance, they might venture out to sea to ensure fishery rights;[199] or

193. In China, rotation of executives is common, aiming to "reduce concentration of authority in a single individual in firms in which institutionalized corporate oversight organs have yet to be developed." Lin & Milhaupt, *supra* note 26, at 741.

194. *See, e.g.*, WORLD COUNCIL OF CREDIT UNIONS, INTERNAL CONTROL REQUIREMENTS 5 (2002), http://www.woccu.org/documents/Internal%20Control%20Requirements (proposing rotation of personnel to facilitate discovery of fraud); *Supervisory Guidance on Required Absences from Sensitive Positions*, BD. OF GOVERNORS OF THE FED. RES. SYS. (Dec. 20, 1996), http://www.federalreserve.gov/boarddocs/srletters/1996/sr9637.htm ("Some institutions, particularly smaller ones, might consider compensating controls such as continuous rotation of assignments in lieu of required absences, so as not to place an undue burden on the institution or its employees.").

195. *See, e.g.*, Stephen M. Bainbridge & M. Todd Henderson, *Boards-R-Us: Reconceptualizing Corporate Boards*, 66 STAN. L. REV. 1051, 1108 (2014) (addressing the limiting of accounting services contracts).

196. Ranking ex ante might still be necessary to determine who to include in the pool of participants. For a discussion of pre-selection, see *supra* note 151 and accompanying text.

197. *Cf.* Perry & Zarsky, *supra* note 38, at 1067 (making a similar comparison between lotteries and other methods). The text uses the word "seem" because determining the pool of rotation participants often involves preliminary screening, which incentivizes pursuers to take actions necessary to increase their likelihood of inclusion.

198. *See* John R. Boyce, *Allocation of Goods by Lottery*, 32 ECON. INQUIRY 457, 473-74 (1994) (making a similar argument with respect to lotteries).

199. *See id.* at 473; *see also* Perry & Zarsky, *Queues*, *supra* note 49, at 1628-29 (discussing wasteful activities caused by queue-based allocation methods).

they might merely waste time waiting in line. Rotation thus avoids the rent dissipation that queues involve.[200] Rotation also saves the costs of resolving disputes over priority.

In other instances, however, rotation-based allocations do not provide incentives for welfare-enhancing conduct that other allocation methods incentivize. In such cases, a choice to allocate via rotation decreases overall welfare. For instance, to meet criteria based on skill or merit, individuals might acquire knowledge and expertise, which enhance welfare, even if they are not ultimately selected to obtain the resource. The prospect of allocation via rotation undermines the incentives to take that course.[201]

2. *Taking Measures to Avoid Rotation*

Assume that courts may use rotation to settle disputes. In other words, rather than granting full possession of a disputed resource to one of the parties and leaving the other empty-handed, the relevant tribunal might decide to temporally divide possession of a physically indivisible resource by rotation. The prospect of dispute resolution by a court-ordered rotation may affect the parties' behavior when negotiating a settlement. It is interesting to examine the actions parties may take in the shadow of a rotation-based solution and their impact on aggregate welfare.

On this point, Ian Ayres and Eric Talley argue that the prospect of divided entitlements, one form of which might be temporal sharing by rotation, has a positive effect on parties' behavior during negotiations. The prospect of rotation induces parties to share more private information in the process of negotiating a settlement and act less deceptively when signaling their buyer or seller price.[202] This is so because the negotiating parties do not know whether they will emerge from the dispute as buyers or sellers of the entire resource at stake, when attempting to end the court-imposed temporal division by way of a consensual buyout. If the threat of temporal division in the case of failed negotiations leads to the resource landing in the hands of the party who truly places the highest value on it, the outcome is economically warranted.

We have examined elsewhere what background assumptions are generally required for these forms of efficient negotiations to unfold.[203] Some further comments are due when this broader argument

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200. *See* David D. Haddock, *First Possession Versus Optimal Timing: Limiting the Dissipation of Economic Value*, 64 WASH. U. L.Q. 775, 776-77, 783 (1986) (discussing rent dissipation in queue-based allocations).

201. *See* Perry & Zarsky, *supra* note 38, at 1069-70 (discussing various examples of incentives for welfare-enhancing conduct of other allocation methods).

202. *See* Ayres & Talley, *supra* note 30, at 1073.

203. *See* Perry & Zarsky, *supra* note 38, at 1077.

is applied in the specific context of rotation. Efficient bargaining will only occur when rotation is destined to fail to generate a mutually beneficial outcome. Ayres and Talley's model assumes that sharing the resource through rotation may reduce its overall value because the whole is greater than the sum of its parts and entail uncertainties with respect to future outcomes.[204] Disputants fear these risks and take various steps, including the disclosure of private information in settlement negotiations, to avoid or limit them. Yet the analysis set out in this Article demonstrates that rotation will not necessarily reduce the overall value of the resource,[205] so the threat of using it cannot always provide an incentive to settle. Moreover, social norms of self-rule, especially in cases of repeated-sequence rotation, can mitigate the costs that rotating resources involves. Rotation might even enhance efficiency when the social norms it generates lead to proper distribution of the roles and workloads necessary for the resource's utilization among the various users.[206] In such instances the prospect of rotation does not incentivize negotiations because the rotation-based outcome is not threatening (or sufficiently threatening) to the negotiating parties. Nonetheless, the notion of negotiating in the shadow of prospective allocations provides an important insight into the possible benefits of the threat of rotation with inefficient outcomes.

D. Administrative Costs

1. Setup Costs

Setting up rotation schemes may involve substantial costs. As explained above, the initial costs include those of determining the relevant pool of participants, assigning participants their initial positions on the roster, and in a multiple-object rotation scheme—assigning to each participant the relevant resource at each time.[207] These costs are not further discussed, as we assume that similar costs are incurred in making the allocative decision using most allocation methods.[208]

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204. *See* Ayres & Talley, *supra* note 30, at 1097.

205. *See* discussion *infra* Section III.E.2.a.

206. *See* Ostrom & Gardner, *supra* note 31, at 107 (providing examples for voluntary distribution of workload in rotational systems).

207. *See, e.g.*, BALAND & PLATTEAU, *supra* note 29, at 207-08 (discussing setup costs in the context of a fishing rotation scheme in Alanya, Turkey).

208. Queue-based allocations usually involve very low costs of this form, while lotteries and auctions are more costly, though less than merit- or need-based allocations. Demarcating the boundaries of the allocated resource entails an inescapable cost in all models. Additional costs common to all methods pertain to the idleness of the resource during the time of the actual allocation. Examining and comparing the relative speed of implementing the various allocation methods is beyond the confines of this project, and most likely calls for a nuanced and case specific analysis. *Cf.* Perry & Zarsky, *supra* note 38, at 1088 (discussing

Still, we wish to make an exception for a unique and particular point of interest regarding setup costs of allocation schemes: valuation. When striving to divide a resource among equal claimants, the allocator must ensure that the value of the allocated shares is equal as well. Spatially and physically dividing resources leads to an abundance of complaints as to whether the shares are of equal value. The prospect of such costs might explain why sharing rules are rare in the context of property disputes between owners and bona fide purchasers.[209] Temporal division, on the other hand, might not generate such prohibitive valuation costs. At first glance, parties need not bicker over which share is more valuable, as all are seemingly equal.[210]

Yet valuation in rotation schemes may sometimes prove complicated, hence costly. This is so, primarily due to what economists call "time preference." People usually prefer to be given a resource now rather than later, so in valuing time-based rewards, future rewards are "discounted" because they are delayed.[211] Thus, a participant's position in the rotation roster in itself affects the value of use. Having an earlier turn means that the benefits derivable from the resource are reaped sooner rather than later, making them more valuable. One possible reason is that the person who obtains the benefit earlier can realize it and invest the proceeds earlier, enjoying greater revenue (assuming the investment is fruitful). Another reason is that an earlier position in the rotation increases the likelihood that the resource will indeed be exploited, given the ever-present chance that unplanned events might cause damage to or even destruction of the resource, or somehow impair the participant's ability to utilize it (as in the case of illness or death). Moreover, in a growing economy, the supply of resources in high demand may increase over time, reducing the future value of a given unit.

As noted above, in some cases the discount can be taken into account in the relative duration of utilization turns, so that those who receive the resource earlier will enjoy it for shorter periods of time.[212] This solution might not always be practical due to the complexity of the underlying calculations and the respective costs. The problem might also be alleviated by shortening the duration of all participants' turns, thereby reducing the potential impact of time-related risks on each participant. Indeed, short terms might be advisable in

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allocation speed and idleness in the case of lotteries); Perry & Zarsky, *Queues*, *supra* note 49, at 1630-33 (discussing setup costs in the case of queues).

209. Levmore, *supra* note 190, at 65.

210. *See* Ayres & Talley, *supra* note 30, at 1081 (discussing resource division along a temporal axis, while accounting for various valuation challenges).

211. John R. Doyle, *Survey of Time Preference, Delay Discounting Models*, 8 JUDGMENT & DECISION MAKING 116, 117 (2013).

212. *See* Ayres & Talley, *supra* note 30, at 1081.

cases where the resource can expire unexpectedly (for instance, when sharing access to an old rocking chair).[213] In such cases, long turns might result in those at the bottom of the roster not getting their share at all.

2. Transfer Costs

Transfer of the resource among participants in a rotation-based allocation involves costs, which can be categorized into three groups: direct costs of the transfer; indirect costs incurred by the participants, the allocator, or others as a result of the transfer; and deadweight losses. The direct costs are those associated with moving the resource from the incumbent user to the new one. At times these are negligible or relatively low. This might be the case when fishing boats sail to their new positions in a fishing-zone rotation scheme,[214] or when rocking chairs or sawmills pass among co-owners.[215] However, at times the complications, risks, and costs associated with the transfer render it unfeasible. A clear example is the allocation of organ transplants;[216] the costs and risks involved in any such transplant render the initial allocation permanent. In other instances, such as those pertaining to the use of land, the costs of mobilizing equipment and workers are substantial but might be mitigated by the benefits that rotation schemes bring about (including warranted ex ante and ex post effects discussed above).[217]

In some instances the direct costs associated with rotation are negligible, but the indirect costs are substantial. For instance, rotating employees among positions might not only involve the limited costs of moving them from one desk to another (although the two desks might be thousands of miles apart).[218] It also involves the high costs of training the rotating participants for their new positions. Similarly, consider military drafts. The direct and indirect transfer costs are affected by the number of positions that need to be filled at any given time and by the frequency of alternating forces. In the Vietnam War, soldiers were posted for twelve-month tours and replaced thereafter. The direct cost was that of frequently transferring troops to and from the front. Beyond that, a longer service period with lower

213. *See In re* Estate of McDowell, 345 N.Y.S.2d 828, 830 (N.Y. Sur. Ct. 1973) (ordering rotation in such a case).

214. *See* BALAND & PLATTEAU, *supra* note 29, at 203-04 (presenting a rotation-based fishing system).

215. *See* Kuperman, *supra* note 5, at 280 (discussing such cases).

216. *See* YOUNG, *supra* note 10, at 12-13 (using this case to explain where rotation might be unreasonable).

217. *See* Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131, 166 n.128 (2000) (discussing the costs and benefits associated with land-use rotation).

218. In such a case, the employee and his or her family may incur substantial relocation costs.

turnover could reduce the indirect cost of training soldiers.[219] Although relevant mostly to this Article's last Section (discussing rotation's impact on the allocated resource), we mention here for completeness that frequent rotation of military forces could also frustrate the development of unit cohesion and curb soldiers' morale, thereby undermining the value of the service.[220]

Finally, the time during which some or all participants do not use the resource may generate additional deadweight losses. These costs might result, first, from the participants' or the resource's idleness in the interval in which the resource changes hands. For example, no one works at the sawmill while its operation is passing from one party to another. Yet even greater deadweight costs might result from the idleness of various instruments utilized by the participants to derive value from the resource. These costs might accrue even when the transfer of possession is seamless. For example, both the British[221] and Israeli[222] broadcasting authorities rotate the use of broadcast spectrum among licensees on a temporal basis. In other words, the same electromagnetic spectrum is allocated to different licensees, who use it to broadcast at different times. When these broadcasters are not "on the air," their production facilities lie relatively idle.[223] Note, however, that the instrument idleness argument does not apply where participants can put their means of production to alternative uses when the allocated resource is rotated to others. The deadweight losses may be mitigated, for example, in cases of multiple-object rota-

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219. *See* Konow, *supra* note 43, at 1230. A longer service period may, of course, prove unwarranted for other reasons.

220. *See* Bradley Dean Helton, Revolving Door War: Former Commanders Reflect on the Impact of the Twelve-Month Tour upon Their Companies in Vietnam 14 (2004) (unpublished M.A. thesis, North Carolina State University), http://repository.lib.ncsu.edu/ir/bitstream/1840.16/1733/1/etd.pdf (noting, additionally, that others made opposite arguments in this context). At any rate, this scheme was justified mostly in terms of fairness. *See also* WALZER, *supra* note 31, at 169 (discussing the impact of rotation among miners or lack thereof on miner solidarity).

221. In the UK, three forms of broadcast licenses for Channel 3 are allocated—for weekdays, weekends, and morning broadcasting (although sometimes one entity receives more than one). *See, e.g.*, London Weekend Regional Channel 3 Licence 57 (Jan. 31, 2014), http://licensing.ofcom.org.uk/binaries/tv/itv/lwt/London_Weekendvar_13.pdf (detailing days and times of broadcast); London Weekday Regional Channel 3 Licence 56 (Jan. 31, 2014), http://licensing.ofcom.org.uk/binaries/tv/itv/carlton/London_Weekday_Consolidated_schedule.pdf (same); Breakfast National Channel 3 Licence 51 (Jan. 31, 2014), http://licensing.ofcom.org.uk/binaries/tv/itv/gmtvdaybreak/ITV_Breakfastvariation19.pdf (same).

222. *See* Second Authority for Television and Radio Law, 5750-1990, SH No. 59 (Isr.), http://www.moc.gov.il/sip_storage/FILES/2/3892.pdf (explaining how the Israeli broadcast authorities provide multiple franchises for the operation of the same channel). For details on the actual rotation among Channel 2 franchise holders, see *Channel 2*, SECOND AUTHORITY FOR TELEVISION & RADIO, http://www.rashut2.org.il/english_channel2.asp (last visited Feb. 27, 2016).

223. This argument is only partly accurate, because even during down times, facilities can be used for taping future programs. Even so, some forms of equipment could have been used to a greater extent.

tion schemes, where the resources, the participants, and their means of production are rotated in concert. They may also be mitigated when the participant can produce alternative products with the same means, or transfer the means for a fee to third parties who can utilize them.

The extent of the costs of the participants' and their equipment's idleness also depends on the unit used in the rotation design. Time-based rotations promote the system's predictability.[224] Here, participants know in advance when their turns start and stop, so they can prepare for alternative uses of their time and means of production when unable to utilize the allocated resource. Quota-based rotations do not allow for proper planning and exacerbate the deadweight loss.

3. *Operating Costs*

a. *General*

Most allocation methods involve a relatively simple implementation following the allocative decision. For instance, a lottery is concluded once the winner receives the resource. Allotment and conversion are complete as soon as the resource is sold and the proceeds are distributed.[225] Rotation, on the other hand, involves a continuous operation following the allocative decision. Sometimes it may be relatively simple. It might even be self-governed by the relevant parties, as in the case of siblings rotating a bequeathed rocking chair among themselves. In such cases, operating costs are limited.[226] In others, the rotation must be supervised to ensure a timely and appropriate transfer of the resource or burden. In these latter situations, the operating costs, including those of potential dispute resolution, must be taken into account in the assessment of the process's efficiency.

Operating costs generally rise as the rotation design gets more complicated, involving more participants and allocated objects, requiring more information, and creating more friction points. Clearly, operating costs correlate with the number of rotation participants. Moreover, they are higher in repeated-sequence as opposed to one-off sequence rotations due to a greater number of transfers, in multiple-object as opposed to single-object rotations due to a larger number of rotated objects, and in quota-based as opposed to time-based rotations due to the need for information about the actual measure of utilization by each participant.

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224. *See* OSTROM, *supra* note 23, at 76 (discussing the advantage of time-based rotation).

225. *See* discussion *supra* Section II.C.1.c (comparing rotation to allotment and conversion).

226. *See In re* Estate of McDowell, 345 N.Y.S.2d 828, 830 (N.Y. Sur. Ct. 1973).

In addition, as a broad rule of thumb, a more costly administrative operation is required when rotation involves players with more limited social interaction, within or outside the rotational scheme. The lack of social relations hinders the development of social norms that can govern the rotation effectively[227] and entails external administrative intervention. For instance, consider timeshare developments, where the use (and sometimes, ownership) of a specific land unit is shared on a short-term, even weekly, basis. [228] The "administrative clumsiness" (as Robert Ellickson put it) involving the operation of such timeshares might even undermine the quality of the timeshares as an investment.[229] These costs involve the monitoring and enforcement of a timely change of hands as well as proper use throughout the period. Although such costs may be high in repeated-sequence rotations, they would probably be higher still in one-off sequence rotations, when tit-for-tat strategies do not unfold, and social norms are less likely to develop. This relative advantage of repeated-sequence rotations from an administrative-costs perspective should be balanced against their relatively greater complexity explained above.

Beyond the possible emergence of social norms emanating from social interactions, the administrative costs generated by rotations might be mitigated by an important additional factor. The notion of taking turns and sharing resources is one that most individuals are familiar with and accustomed to from childhood. Indeed, several researchers have observed that people are educated from a young age to "take turns."[230] Because people are "trained" in passing on resources they currently use to others, sometimes on the understanding that they may reclaim them in the future, rotation can be a natural process, exercised smoothly and without the need for substantial external intervention.

The operating costs of a rotation process can be divided into two stages: (1) "changing hands," namely the transfer of use, and (2) the ongoing use. We examine each in turn.

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227. *See* MICHAEL HELLER, THE GRIDLOCK ECONOMY 196 (2008) (explaining that reputation works best as a self-policing tool "in communities in which people have multiple links to one another, meet for repeat dealings, and control low-value uses," not in "large, diverse, or anonymous groups who are in onetime transactions" such as timeshares).

228. Ellickson, *supra* note 187, at 309.

229. *Id.* at 293 n.252.

230. *See* Elinor Ostrom et al., *Regularities from the Laboratory and Possible Explanations*, *in* RULES, GAMES, AND COMMON-POOL RESOURCES 195, 217-18 (1994) (discussing the notion of education to "take turns"); *see also* Kevin Gray, *Property in a Queue*, *in* PROPERTY AND COMMUNITY 165, 194 (Gregory S. Alexander & Eduardo M. Peñalver eds., 2009) (same).

b. Changing Hands

The first cost to discuss is that of identifying the point at which the resource should change hands, and enforcing the transfer. Here we must distinguish between the two possible bases for determining the extent of every period of use within the overall scheme. With time-based rotations, such measurement is easy to establish and difficult to dispute. The administrating authority's role might be limited to setting ex-post fines on those who refrain from transferring control in a timely fashion.

Alternatively, as explained in the Introduction, rotation might be quota-based. Here, monitoring is necessary to determine whether the triggering event has occurred.[231] In some cases, technological solutions might help limit these costs. For instance, in rotation-based irrigation systems measuring the amount of water used could be established by special meters. In other rotation-based systems, monitoring might be more difficult and call for participants' close cooperation in providing information about their use. In both instances, participants might deceive, manipulate, or conceal information from the monitoring scheme (sometimes using technology) so as to obtain additional use of the resource.[232] Countering these attempts might also entail costs.[233]

The operating costs might be reduced if the participants engage in effective self-rule. Indeed, in some rotation structures reported by Elinor Ostrom, that is, rotational allocation of priority in irrigations systems and rotational allocation of fishing rights in certain fisheries, self-monitoring took place.[234] In these cases, incoming and outgoing participants were in close proximity, physically interacting towards the end of each turn, thereby ensuring that no one oversteps his or her allocated time by starting too early or ending too late. Self-policing might occur even with quota-based rotations, albeit in a somewhat different form. For instance, in a quota-based rotation of a fishery, participants can monitor each other at markets and other points of congregation where they can examine their peers' catches to establish if rotation rules have been breached. In all such cases, enforcement of the rules might be informal—through shaming, harming

231. *See* OSTROM, *supra* note 23, at 71-72 (discussing the rotation of irrigation rights, which featured ditch riders who examined whether participants met or exceeded their allocated quota); *see also* YOCHAI BENKLER, THE PENGUIN AND THE LEVIATHAN: THE TRIUMPH OF COOPERATION OVER SELF-INTEREST 149 (2011) (discussing these issues).

232. *See* Ayres & Talley, *supra* note 30, at 1029 (explaining that divided ownership creates or exacerbates strategic behavior).

233. These costs should only nominally change if the rotation is proportional rather than simple (equal-share).

234. OSTROM, *supra* note 23, at 95-96, 204-05.

of reputation, or retaliation against the breaching individual.[235] Of course, these forms of self-monitoring are more effective in repeated-sequence rotations and multiple-object rotations, where the participants' interaction is more intensive, and an effective "tit-for-tat" threat is present. Certainly, when a repeated-sequence rotation loses its repetitive character following the frequent transfer of time-shares from the original participants to third parties, the entire social system enabling self-rule might collapse, increasing the rotation-based system's operating costs.[236]

Still, Ostrom's self-rule story might be too optimistic, and unsuitable in many contexts. As Lee Fennel points out, "proximity might heighten the chances of provocation and conflict,"[237] increasing expected dispute resolution costs. Therefore, the success of self-policing will depend on a variety of cultural factors, shared norms in the participants' community, and reputational stakes.[238] It might also prove more effective if participants are somewhat insulated from external social dynamics and develop mutual dependencies.

c. Monitoring Use

A generally greater component of the administrative cost is that of constant monitoring of the shared asset. When the resources allotted via rotation are exhaustible[239] and their value may diminish by inappropriate use, various steps might be required to ascertain that users do not overstep and overuse the resource, or use it in various unacceptable ways, while generating negative externalities.[240]

In some instances, this challenge could be addressed by merely monitoring at the point of changing hands. At this point, the monitoring agent can establish whether the previous user has abused or misused the resource. In such instances, and subject to the caveats noted above, this form of monitoring could be conducted successfully through self-rule.[241] Sometimes a commercial entity has to come in to

235. *Cf.* ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (1991) (discussing the use of these measures in a somewhat different context).

236. *See* BALAND & PLATTEAU, *supra* note 29, at 272 (explaining that rotation systems in Sri Lanka disintegrated, inter alia, due to the impact of increased market penetration).

237. Lee Anne Fennell, *Ostrom's Law: Property Rights in the Commons*, 5 INT'L J. COMMONS 9, 11 (2011).

238. *Id.*

239. If the resource is not exhaustible, the problem does not arise. *See supra* note 141 and accompanying text.

240. The underlying assumption is that rational participants in a rotation-based system will take various steps to merely improve their own condition (here by overusing the resource) and not the overall good. Lee Anne Fennell, *Commons, Anticommons, Semicommons*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 35 *passim* (Kenneth Ayotte & Henry E. Smith eds., 2011).

241. *See* OSTROM, *supra* note 23, at 95-96 (discussing self-rule).

inspect these issues, and possibly sanction participants who do not meet required standards at the time of transfer.

Yet in other instances, such as those involving land, mere inspection at the time of rotation might be too little or too late for at least two reasons. First, misuse or overuse of the allocated resource might not be apparent during the transfer, and therefore noticed only after a time.[242] In such cases, once the diminished value in the resource is noticed, it might be impossible to establish which of the rotating users caused this outcome. This uncertainty might incentivize parties to engage in covert overuse, for which they can easily blame fellow users. Second, overuse might cause substantial harm and must therefore be detected and stopped in real time. Punishing the overuser/abuser after the fact would—again—prove too little and too late. In such instances, continuous monitoring might be called for.

At times, monitoring can be carried out by some of the rotation participants, for example, through voluntary patrols and inspections.[243] Studies indeed show that a considerable proportion of community members are willing to engage in such monitoring even when there is no reasonable expectation of payment for their actions.[244] The incentives for such actions are, most likely, internal: maintaining trust or seeking vengeance and retribution.[245] In such situations, the costs of monitoring might be limited. In other instances, a private entity funded by the rotating parties or a public authority will be vested with the monitoring power. The cost of employing this entity might undermine the efficiency of this allocation method. Sometimes monitoring may be carried out through the use of automated mechanisms at a yet unclear cost.[246]

E. External Effects

1. Impact on Third Parties: "The Tragedy of the Anticommons"

Occasionally, a rotation-based allocation generates a layered structure of rights pertaining to a specific resource through temporal fragmentation.[247] This outcome of rotation, which distinguishes it from other allocation methods that can be applied to physically indivisible resources, may encumber a future transfer of the underlying

242. Indeed, Ostrom explains that those who argue that repeat actions will lead to compliance assume that information regarding the various actions parties carry out is available. Yet such information is in fact rarely openly available, and thus must be actively collected via monitoring. *Id.* at 93.

243. *Id.* at 94 (discussing self-enforcement); *see* Samuel Bowles & Herbert Gintis, *Social Capital and Community Governance*, 112 ECON. J. 419, 424 (2002).

244. Bowles & Gintis, *supra* note 243, at 425.

245. *See id.* at 424.

246. *See* BALAND & PLATTEAU, *supra* note 29, at 284.

247. *See* Smith, *supra* note 217, at 165.

resource. In doing so, rotation imposes negative externalities on those striving to purchase the entire resource in the future. In other words, if a third party who is a potentially efficient user is interested in purchasing the resource, the fact that it is sliced temporally to enable rotation will generate high, possibly even prohibitive, transaction costs. Rather than negotiating with one right holder, the interested third party will be bound to find and negotiate with many. In addition, each of the co-users might generate a "hold-out problem." This dynamic resembles the one Michael Heller dubbed "The Tragedy of the Anticommons"[248]—the problem of assembling permissions or entitlements when such assembly may generate a surplus.[249] Such an outcome will most likely reduce aggregate welfare.[250] The extent of this reduction depends on the number of individuals sharing one specific resource, as every additional participant may increase transaction costs.

This shortcoming of the rotation process may be less troubling in two types of cases.[251] First, applying a rotation might lock in place a multiple-user utilization structure and promote the development of social order, cooperation, and harmony around it (including self-governance norms). At times property is more valuable when fragmented.[252] When rotation creates an efficient, fragmented structure, the prohibitively high transaction costs preserve it by rendering the resource more resilient to unwarranted external takeover attempts. The resilience of the rotation model might also generate positive externalities in the form of developing and maintaining social structures that impact broader population circles. For instance, in some settings rotation maintains the peace among many potentially rival members of society and fosters social cohesion. Transferring all rights in a resource to a single user prevents or eliminates the positive social effects of continuous sharing. In the case of an existing rotational scheme in a small community, and the social order which evolved around it, such a transfer may even lead to social collapse. At any rate, the loss of harmony and solidarity in a specific community

248. Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 *passim* (1998). Elsewhere, Heller justifies the rule against perpetuities as an attempt to limit inter-temporal fragmentation. Michael A. Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163, 1179 (1999). For further discussion, see Bell & Parchomovsky, *supra* note 191, at 1034; Fennell, *supra* note 240, at 41.

249. Fennell, *supra* note 240, at 41.

250. *Cf.* Ellickson, *supra* note 189, at 1368-71 (addressing the benefits of "perpetual land ownership").

251. *Cf.* Fennell, *supra* note 240, at 41 ("[J]ust as commonly owned property does not inevitably lead to a commons tragedy, the dispersal of veto rights does not automatically create an anticommons tragedy.").

252. *See id.* at 48.

may have a negative impact on aggregate welfare.[253] Where the potential loss is significant, the high transaction costs actually enhance efficiency by preventing an unwarranted transfer of rights. Of course, if a rotational model eventually ceases to generate the positive externalities mentioned here and becomes less efficient than alternative regimes, it can be actively discontinued. At that point, the anticommons problem and the enhanced costs it brings about might be overridden by direct governmental action (such as takings),[254] subject to constitutional constraints.

Second, while temporal division might render it very costly for an external (non-participating) party to acquire all rights in the rotated resource, it might be somewhat less costly for one of the alternating-users to do so. This is especially true when each of the rotation participants could end up as either a buyer or a seller in the negotiations among the participants.[255] As explained above, disputants who negotiate a settlement under the threat of a court-ordered rotation are incentivized to disclose private information as part of the negotiations, facilitating an efficient settlement.[256] When rotation participants negotiate with each other, they have similar incentives, because they negotiate under the threat of continued rotation. By disclosing information, they reduce transaction costs. Yet the efficiency of this internal-negotiation dynamic depends on the nature of the initial process used for selecting rotation participants.[257] When the preselection process identifies and includes the potentially highest valuer of the resource, the transaction costs brought about by the "anticommons problem" will not be great.[258] The resource may end up in the hands of a person who can nearly maximize its utility, although a person who values the resource somewhat more might still exist outside the pool of participants.

253. This happened in some of the rotation-based systems studied by Ostrom and others, which were efficient for centuries, but deteriorated rapidly due to the entrance of external forces. *See* Ostrom & Gardner, *supra* note 31, at 104.

254. *See* Fennell, *supra* note 240, at 48.

255. *See* Ayres & Talley, *supra* note 30, at 1087.

256. *See id.* at 1097.

257. *See id.* at 1087.

258. Ayres and Talley further note that even if the "highest valuer" in the initial pool will not maximize the use of the resource, at least the efficient negotiations among members of the group will facilitate the concentration of rights in the hands of one member who can later sell them to an external party. *Id.*

2. *Impact on the Allocated Resource*

a. *Resource Improvement*

The fact that a resource is allocated and shared through rotation may change the rotated resource in various ways.[259] The first, intuitive, trajectory of such a change is negative. Rotation participants have an incentive to engage in strategic behavior.[260] Earlier users might degrade the resource. Even if monitoring measures are capable of limiting degrading activities by various users, some degradation might nonetheless occur. Additionally, rotations provide limited incentives for individuals to improve the underlying resource, as they are unable to reap the full benefits of such investment and need to share them with subsequent users.[261] The subsequent users are in fact "free riders"[262] who might even be competing with the investing user in various markets. Needless to say, disincentivizing efficient improvements is economically unwarranted.

Still, in some rotation-based allocations, the prospect of future improvements by various participants need not be so bleak, especially with repeated-sequence and multiple-object rotations. When the rotation process is indefinite, subsequent users might—without any legal or contractual obligation—react to individuals initially improving the resource by making improvements of their own, adopting a "tit-for-tat" strategy.[263] Users will respond to the benevolence of others with their own benevolence on the assumption that they will be rewarded in the others' next turns. A similar dynamic might develop when a finite number of rotations is set, but it is uncertain when the rotation game will actually end due to external events.[264] When the user-sequence is not repeated, or repeated only a few times, participants will engage in backward induction and refrain from fully cooperating with others.[265] Alternatively, participants may devise a consensual arrangement for resource improvements. Such an arrangement calls for an enforcement mechanism. It is necessary to determine whether

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259. *See* YOUNG, *supra* note 10, at 28 (discussing the possible impact of rotation on the allocated resource).

260. *See supra* notes 142-43 and accompanying text.

261. *See* Richard A. Epstein, *Past and Future: The Temporal Dimension in the Law of Property*, 64 WASH. U. L.Q. 667, 695 (1986) (explaining that not allowing indefinite property rights undermines investments in long term improvements).

262. *Cf.* Smith, *supra* note 217, at 166 n.129 (explaining that "[r]otation dulls private incentives for legitimate improvements to land").

263. *See* DOUGLAS G. BAIRD ET AL., GAME THEORY AND THE LAW 167 (1994) (presenting this tactic).

264. *See id.*

265. This means that players will choose to "defect" and refrain from cooperating in the last rotation round but then realize that in the round before it, cooperation is ill advised, as it will not be rewarded, and so on, until reaching the starting point of the rotation, at which they will refrain from cooperating as well. *See id.*

specific users have defected or cooperated and to respond accordingly. When voluntary arrangements are destined to fail, the government might need to mitigate this concern and enhance resource improvements by introducing rewards to those who carry them out or imposing sanctions on those who do not.[266]

Self-regulation and enforcement in rotation schemes need not fail. Some forms of rotation actually generate mutual dependencies and thus induce all participants to invest directly in the upkeep of the underlying resource. This issue is best demonstrated by Ostrom and Gardner, discussing irrigation schemes that rotate the "head" and the "tail" of the system over time.[267] In a "state of nature game," which does not involve rotation, those at the head of the irrigation system ("headers") receive more water, and those at the tail ("tailenders") receive smaller amounts and therefore have only limited motivation to take part in the required maintenance of the system. Thus, the system features an inherent asymmetry of power between the headers and the tailenders, the latter being subjected to the good graces of the former. Given unsatisfactory maintenance, the production of water is less than optimal.[268]

However, when headers and tailenders rotate the right to receive the water first,[269] all participants are equally motivated to contribute to the ongoing maintenance of the entire system, as the noted power asymmetry is mitigated. Even those near the tail at a given time have assisted in repairs at the system's head, as they understand that once the flow is reversed, the repairs will substantially impact them as well.[270] The rotation therefore created mutual dependencies which generated social norms that motivated the upkeep of the system. When external funding from the central government or an international entity led to the establishment of new permanent waterworks, which substantially reduced the need for labor and reliance on mutual dependencies in improving the system (but did not eliminate the basic power asymmetry), the entire social structure collapsed.[271] Farmers ceased to cooperate, conflicts arose, and eventually the supply provided by the new irrigation system to the tailenders started to decline[272]—all clearly inefficient outcomes.

Admittedly, the maintenance work carried out by the participants could have been provided in alternative ways, which did not hinge on

266. *Cf.* Smith, *supra* note 217, at 166 n.129 (noting that the "arrangements were made to reward efforts at improving the quality of the land").

267. Ostrom & Gardner, *supra* note 31, at 97-98.

268. *Id.* at 98.

269. *Id.* at 99.

270. *Cf. id.* at 96 (explaining that without rotation, tail-enders have limited motivation to contribute to the system's maintenance).

271. *See id.* at 104.

272. *Id.* at 105; *see also id.* at 109-10 (discussing the implications of asymmetries and appropriation problems on head-end and tail-end farmers generally).

the implementation of a rotational allocation of irrigation water. For instance, all participants could have contributed to a fund paying for maintenance tasks on an ongoing schedule, or headers could negotiate an agreement with tailenders, promising them a certain amount of water in exchange for their labor.[273] Yet these alternative measures would undoubtedly have involved transaction costs, which were saved when rotation was applied. Of course the rotation itself entails costs, which must be considered in comparing the options.

b. Public Perception of the Resource and Behavioral Impact

Sometimes rotation contributes to changing the common perception of the allocated resource in a potentially welfare-enhancing way. For instance, when allocating tasks or burdens, the fact that the allocation is through rotation might impact the way said tasks (and those executing them) are perceived. This insight mostly pertains to what Michael Walzer refers to as "hard work"—work that is "harsh, unpleasant, cruel, difficult to endure."[274] In many countries such work is allocated to the weakest segments of society, who are further degraded by the work they do.

Now assume these tasks are rotated.[275] In such a case, the "negativity" of the tasks is reduced and overall welfare is enhanced.[276] Stigma no longer attaches to those performing these tasks because everyone performs them.[277] Tasks once considered degrading and repulsive will no longer be considered as such, so the loss of welfare incurred by those carrying them out is reduced.[278] The self-degrading nature of work may reduce aggregate welfare beyond the feelings of shame and humiliation. For instance, garbage collection is considered a dangerous activity with a very high accident rate. Some of the accidents might result from the low self-esteem and disrespect associated with this job.[279] These, too, might be limited by rotation.

Moreover, rotation not only lessens stigma and its welfare-reducing implications, but also generates behavioral changes which might reduce the extent of unpleasant tasks. For instance, if street cleaning were rotated among all citizens, people would better under-

273. *Id.* at 99.

274. WALZER, *supra* note 31, at 165.

275. *See* ELSTER, *supra* note 9, at 73 (addressing the use of rotation for assigning tasks like floor washing or switchboard operating in a communal enterprise).

276. *See* WALZER, *supra* note 31, at 173-74 (explaining that in some instances, negative goods—such as kitchen duties—could not be transformed and were shared among all participants for egalitarian reasons).

277. For a discussion of this effect from a fairness perspective, see discussion *supra* Section II.C.2.b.

278. *See* WALZER, *supra* note 31, at 174 (quoting GEORGE BERNARD SHAW, THE INTELLIGENT WOMAN'S GUIDE TO SOCIALISM AND CAPITALISM 75 (1928)) ("If all dustmen were dukes nobody would object to the dust . . . .").

279. *Id.* at 178.

stand the hardship it involves, respond by changing their behavior, and litter less. This, in turn, would reduce the need for street cleaning.[280] Furthermore, the rotation of unpleasant tasks (or other burdens) among broad segments of society might influence political decisions and policy choices concerning the need to perform them and the existence or development of alternatives.[281] When society does not merely "dump" the hard work on a weaker social segment but instead distributes the burden broadly, it seriously considers whether such a burden should and could be limited. Rotation may thus incentivize public investment in developing new technologies. For example, rotating sanitation duties may lead to the development of automated sanitation systems which are more effective or less degrading for their operators. Rotation may also incentivize burden-reducing policy decisions. For instance, rotating the burden of coal mining might result in a decision to switch to other sources of energy.

Arguably, the policies adopted following the rotation of these tasks and burdens will be more efficient than existing policies.[282] Absent such rotations, the political process might impose greater costs on the weakest social groups. Rotations provide incentives for reducing these costs. However, it is possible that a similar effect could be achieved through less costly measures, such as expert committees.

IV. CONCLUSION

This Article has made several contributions to the understanding of the actual and potential role of rotation in the allocation of resources and burdens, particularly, but not only, in legal contexts. It has done so on three interrelated levels: doctrinal (the concrete level), conceptual (the intermediate level), and theoretical (the abstract level). More specifically, it has interwoven (1) concrete allocative challenges in numerous legal contexts, (2) several variables and conceptual distinctions that a rotational system design involves, and (3) a systematic theoretical framework integrating fairness- and efficiency-oriented concerns. Let us succinctly point out a few of the many insights our integrative analysis has provided.

Generally, we have shown that different features in a rotational-system design may have different effects on various determinants of the system's fairness or efficiency. At some points, the analysis has unveiled situational features which make rotation more defensible in terms of both fairness and efficiency. For instance, rotations are more likely to satisfy both demands when applied to a homogeneous pool of

280. *See id.* at 175.

281. *See* GOODWIN, *supra* note 14, at 163-65 (discussing the possible impact on political decisions).

282. For a comprehensive discussion of this argument in the related context of lotteries, see Perry & Zarsky, *supra* note 38, at 1084-86.

participants. Thus, when considering rotation, it may be helpful to determine whether the pool actually furnishes this prerequisite. In addition, both fairness and efficiency considerations require measures to assure that participants do not diminish the allocated resource during their respective turns.

Sometimes various concerns within a single rubric—be it fairness or efficiency—might be incongruent. In such cases, an internal balance is necessary to determine whether rotation is comparatively efficient (or fair). For example, the distinction between one-off sequence and repeated-sequence rotations is of limited significance in terms of first-order fairness, especially if the detriment of delayed use could be compensated for. However, repeated-sequence rotations might enhance inter-participant fairness, as well as social virtue among participants and even non-participants (second-order fairness). This feature also has mixed effects in terms of efficiency. A repeated-sequence design may increase the system's complexity and the resulting administrative costs; on the other hand, it possibly helps strengthen social norms of reciprocity which contribute to the mitigation of administrative costs.

In other cases, fairness and efficiency pull in opposite directions, and a value judgment is necessary. For example, we have demonstrated that quota-based rotations might sometimes be preferable to time-based rotations in terms of first-order fairness. This may be so where the value of time-shares varies due to variation in participants' utilization capacity or to changes in the resource itself caused by seasonal fluctuations or unpredictable events. However, from an efficiency perspective, quota-based rotations are more difficult to govern and generate special administrative costs, making time-based rotations more cost-justified.

Furthermore, this Article compared rotation with competing allocation methods from the dual perspective of fairness and efficiency, with a particular focus on lotteries and queues. The relations among these three nonconventional allocation methods can unfold in various ways. On one level, they can be combined to enhance fairness and efficiency. For instance, rotations call for a limited pool of users. The other methods could be applied to select rotation participants out of all actual or potential pursuers. On another level, allocators must often choose among these competing options. For example, should irrigation rights, fishing spots, positions at work, or political power be allocated using the first-come, first-served principle; a lottery; or rotation? The answer depends not only on context, but also on politically determined priorities. This Article facilitates an informed decision.

Finally, our study has revealed a surprising paucity of empirical research on common perceptions and possible effects of rotation. In

recent decades the law has justifiably moved to embrace, and possibly even rely on, empirical studies. The proper role of rotation can only be assessed after an additional layer of behavioral research is done, in both the lab and the field. This will illuminate, inter alia, the public's nuanced attitudes to rotations, in itself and compared to other allocation methods, and the valuable social norms that rotational schemes might foster. The variables, conceptual distinctions, and theoretical arguments this Article has put forward can inspire and underpin such research, which we certainly hope will follow.