

# Tail Risk of Contagious Diseases

Pasquale Cirillo\* and Nassim Nicholas Taleb†

\*Applied Probability Group, Delft University of Technology

†Tandon School of Engineering, New York University

Forthcoming, *Nature Physics*

**Abstract**—Taking up a novel constraint for justice in distribution, which is equality between cultures, we suggest that the Lockean method of appropriation is lacking and suggest a new novel method which solves the issue of cultural equality.

## I. INTRO

This paper attempts to present an alternative theory of appropriation which solves the main issues presented with Lockean appropriation.

The purpose of this article is to present a culturally neutral method of appropriation. The theory simultaneously allows for a much wider application of the appropriation principle and solves ethically problematic issues that are present within the criteria that Locke presents. Specifically, the method presented purports to be *Culturally* neutral.

A method of appropriation which is culturally neutral, and allows for a much wider scope for appropriation.

Ever since Nozicks seminal book, political philosophy has been aiming to correct what is seen as Nozick's most fragile part. Nozick's theory is powerful in that the theory allows is holistic, that is, it is a grand theory of justice, it is coherent with a wide variety of methods. That is, theory requires a method of appropriation which is just, regardless of what the specific method is. The method of appropriation he proposed, what is widely known and criticized and the "Lockean proviso" has severe limitations.

The structure of the article will be as follows: We will briefly discuss why the Lockean proviso fails the test of cultural neutrality.

Locke in his theory of appropriating property had the following position. The state should recognize somebody as having a property right over an object if they mix their labor to improve that object in some way. Now there are a number of issues with this, the definition of "improve", the SCOPE the property right. For instance if I plant a small seed somewhere do I also own something 10m away from the seed, even though I technically did not adjust it?

If so it seems like this is inherently tilting things in FAVOR of those who can appropriate en masse, for instance somebody with a tractor can just terraform mass amounts of lands and this would meet the appropriation criteria.

Worse yet, it is notoriously known that Locke himself didn't think indigenous tribes should have property rights over their

territory. Clearly any property right rule should be indifferent between people or groups of people.

So what is the rule that CAN allow for appropriation while remaining neutral?

## II. THE PROBLEM OF A CULTURALLY NEUTRAL THEORY OF APPROPRIATION

The problem of a culturally neutral method of appropriation is a notion which often goes ignored. To illustrate the idea of a culturally/preference neutral notion we give a brief example.

Suppose agent A and agent B are attempting to create a theory of just appropriation, but instead of being completely blind in the veil of ignorance sense, they have some information about their own tendencies or preferences. Specifically, suppose that A is a lazy mediterranean and B is has a strong dose of that Legendary protestant work ethic.

What would the two agents agree to as a method of appropriation? Would they agree to a Lockean concept? Because A is lazy, he doesn't want to tire himself out, instead he just likes to take walks on the island and pick the fruit that naturally grows there. A likes to pick fruits from trees, while B likes to cut trees down and plant crops. Now it seems like B would earn property rights over the territory he destroys and re-creates but A would gain no such rights.

This is a serious issue, indeed suppose that B gradually becomes more efficient and is able to gradually appropriate all of the land, such that A no longer has any claim to any assets. Perhaps B also values diversity in agriculture so he gradually plants different vegetables over the whole island.

Take a second situation, suppose now that both our agents have a strong protestant work ethic. However as it so happens agent A, has a large tractor while Agent B has preference for working with his hands. Suppose that once again they agree to the Lockean method of appropriation, it is clear that the agent with the tractor will appropriate the 99

The idea is NOT that the two should have an equal amount of land appropriated but that both cultures can survive. Indeed if a rule causes one persons preferences to disappear and another ones to thrive, this is not a culturally neutral rule.

Indeed, if an agent intends for a piece of land to be used by his offspring, this means that another Agent cannot simply come and appropriate it before the offspring is old enough and then limit what the offspring can do.

Give tractor example, explain how it favors some cultures over others. It ignores some actions but accepts others, one cannot help that the criteria for ownership is inherently biased in favor of the actions which are his own cultural heritage.

but instead emerges from a process of deliberation which aims to be neutral AMONG humans.

### III. THE PROBLEMATIC LOCKE

This section aims to present the problematic context from which Locke emerged and aims to show that his theory is hopelessly tainted by his own culture.

More precisely, the theory does not emerge from a process of deliberation which aims to justify one's own culture, indeed Locke was notorious for his silence on the issue of slavery and unapologetic push for the westernization of native lands.

The limitation of Lockean appropriation.

### IV. HAYEKIAN APPROPRIATION

This section presents a method of appropriation which is culturally neutral.

More precisely the rule is about intent and planning. That is if agent A plans or intends on using a physical object that no other person intended on using this is sufficient for giving a property right.

Nor does the intent have to be explicit, if a certain tribe has gone up the mountain for a ritual for thousands of years, this can be taken as cultural intent to use the mountain and they should be given those property rights.

Like Nozick's vision of the Lockean proviso, this vision is radical, indeed, it entails simultaneously that a large majority of current property rights are illegitimate.

However this intent to use does not give the timeless application of property rights that Locke's theory gives. While the right CAN be permanent it does not have to be active all the time.

Indeed this makes for a less radical vision of property, for an appropriation to occur, it must simply be that OTHER's plans for the physical asset are not diverted.

Suppose that a country house of family B is used once a year and it stays unused for the rest of the year. This means that the use of this asset is open for appropriation. However the criteria for appropriation must NOT affect the other use of the asset.

For instance suppose B wants to use an asset A plans to use. Then B must make sure that A's plans are not thwarted, in other words, if B uses the asset and damages it, he is liable to A. So the use of the asset WITHOUT permission is granted as long as B compensates A for the damage that is caused. In other words if A plans to use the asset at time 2, A must be indifferent as to whether B had already used it before.

The idealization is deliberate, of course the logistics may make this impracticable. If for instance the asset in question is very fragile, then it cannot be reasonably expected that B can do a follow up appropriation. If A's cultural practice is to PICK a banana from the tree then B can pick another banana as long as there is a banana left. If on the other hand A's cultural practice is to pick a single banana from a COMPLETE tree then it isn't justified. In other words, strong cultural knowledge is required.

Indeed unless the culture makes it EXPLICIT that they picking a single banana is the culture, the LAW should assume

that the plan is to pick from a COMPLETE tree. Note however that IF it were ever made explicit, then the law can afford to be more surgical.

The planning criteria is true Not only for temporal reasons, but state contingent rights as well. For instance it could be that a family has chosen a nice spot that they want to go sun tan on IF the weather is nice. Then they have the right UNDER that circumstance, but this right can be exchanged.

Of course, as to appropriating things under ignorance. That is suppose you see a bench and you do NOT know if anybody has created plans for this bench. What can you appropriate? One can make plans but your OWN plans will be contingent on somebody else's not having plans in the specific state. That is suppose somebody plans to use this at state A but not on state B, and you plan to use it for both state A and B, then one could say that you believe you appropriated for state B and A but you only appropriated for state A.

Then appropriation carries the risk that somebody else has already appropriated this parcel.

Hayek who was notorious for his defense of prices for their function that it enables agents to create mutually compatible plans, using this is the line of inspiration, I propose a similar method but for appropriation. Agents should have property rights over physical resources which they have PLANNED to use.

Let us take an example: suppose that an agent wants to go camping in a forest that already exists once a year. Now suppose the agent has planned to go camping there on day 2. Nobody else was planning to use the property on day 2. Perhaps somebody else is interested in going to the spot for a honeymoon on day 2, but the first agent has already made plans, but he may be willing to sell these plans so that the other agent realize his own plans.

Notice here that the property right that is granted is time and context specific. If for instance the family was planning to go camping and the function of the camping was to be in a rich and natural environment then the property rights on day 1 are bounded that whatever appropriation occurs on day 1 must make sure that it does not violate the property right of the family.

### V. SUPERIORITY OF HAYEKIAN VS LOCKEAN APPROPRIATION

In other words, if something is in USE, it cannot be appropriated. Similarly if something has been discovered already, it also is not in use. Suppose that the family planned to use the asset at time t. Somebody discovered that the asset has ANOTHER more valuable use and wants to dig it out. What must be done?

### VI. OBJECTION TO HAYEKIAN APPROPRIATION AND REPLIES

Ambiguous planning

### VII. CONCLUSION

This is a theory which aims to bring our understanding of property rights closer to the intuitive notions which everyday

people have. For instance, the data of children shouting shotgun while getting in the car.

## REFERENCES

- [1] R. Albert and A.-L. Barabasi (2002). Statistical mechanics of complex networks. *Reviews of Modern Physics* 74: 47.
- [2] M. Arshad , M.T. Rasool, M.I. Ahmad (2003). Anderson Darling and Modified Anderson Darling Tests for Generalized Pareto Distribution. *Journal of Applied Sciences* 3, 85-88.
- [3] P. Cirillo (2013). Are your data really Pareto distributed? *Physica A: Statistical Mechanics and its Applications* 392, 5947-5962.
- [4] P. Cirillo, N.N. Taleb (2016). On the statistical properties and tail risk of violent conflicts. *Physica A: Statistical Mechanics and its Applications* 452, 29-45.
- [5] P. Cirillo, N.N. Taleb (2016). Expected shortfall estimation for apparently infinite-mean models of operational risk. *Quantitative Finance* 16, 1485-1494.
- [6] A. Clauset, C.R. Shalizi, M.E.J. Newman (2009). Power-law distributions in empirical data. *SIAM Review* 51, 661-703.
- [7] L. de Haan, A. Ferreira (2006). *Extreme Value Theory: An Introduction*. Springer.
- [8] C. Donnat, S. Holmes (2020). Modeling the heterogeneity in COVID-19 a??s reproductive number and its impact on predictive scenarios. *arXiv:2004.05272*.
- [9] P. Embrechts, C. Klüppelberg, T. Mikosch (2003). *Modelling Extremal Events*. Springer.
- [10] M. Falk, J. Hüsler J, R. D. Reiss R-D (2004). *Laws of small numbers: extremes and rare events*, Birkhäuser.
- [11] N. Ferguson, D. Laydon, G. Nedjati-Gilani et alii (2020). Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. Available online at <https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-03-16-COVID19-Report-9.pdf>
- [12] K. Goldewijk, K. Beusen, P. Janssen (2010). Long term dynamic modeling of global population and built-up area in a spatially explicit way, hyde 3.1. *The Holocene* 20, 565-573.
- [13] H.W. Hethcote (2000). The mathematics of infectious diseases. *SIAM review* 42, 599-653.
- [14] K. Klein Goldewijk, G. van Drecht (2006). HYDE 3.1: Current and historical population and land cover. In A. F. Bouwman, T. Kram, K. Klein Goldewijk. *Integrated modelling of global environmental change. An overview of IMAGE 2.4*. Netherlands Environmental Assessment Agency.
- [15] J. Nešlehová, P. Embrechts, V. Chavez-Demoulin (2006). Infinite-mean models and the LDA for operational risk. *Journal of Operational Risk* 1, 3-25.
- [16] J.Norman, Y. Bar-Yam, N.N. Taleb (2020). Systemic Risk of Pandemic via Novel Pathogens - Coronavirus: A Note. New England Complex Systems Institute.
- [17] S. Scasciamacchia, L. Serrecchia, L. Giangrossi, G. Garofolo, A. Balestrucci, G. Sammartino (2012). Plague Epidemic in the Kingdom of Naples, 1656–1658. *Emerging Infectious Diseases* 18, 186-188.
- [18] T. B. Seybolt, J. D. Aronson, B. Fischhoff, eds. (2013). *Counting Civilian Casualties, An Introduction to Recording and Estimating Non-military Deaths in Conflict*. Oxford University Press.
- [19] N.N. Taleb (2020). *Statistical Consequences of Fat Tails*. STEM Academic Press.
- [20] N.N. Taleb, P. Cirillo (2019). The Decline of Violent Conflict: What do the data really say? In A. Toje, N.V.S. Bård, eds. *The Causes of Peace: What We Know Now*. Nobel Symposium Proceedings. Norwegian Nobel Institute, 57-85.
- [21] United Nations - Department of Economic and Social Affairs (2015). *2015 Revision of World Population Prospects*. UN Press.
- [22] Ancient History Encyclopedia, retrieved on March 30, 2020: <https://www.ancient.eu/article/1528/plague-in-the-ancient--medieval-world/>.
- [23] Visual Capitalist, Visualizing the History of Pandemics, retrieved on March 30, 2020: <https://www.visualcapitalist.com/history-of-pandemics-deadliest/>.
- [24] World Health Organization, Covid-19 page, retrieved on April 13, 2020: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- [25] Wikipedia List of epidemics, retrieved on March 30, 2020: [https://en.wikipedia.org/wiki/List\\_of\\_epidemics](https://en.wikipedia.org/wiki/List_of_epidemics).
- [26] Wikipedia Great Northern War plague outbreak, retrieved on March 30, 2020: [https://en.wikipedia.org/wiki/Great\\_Northern\\_War\\_plague\\_outbreak](https://en.wikipedia.org/wiki/Great_Northern_War_plague_outbreak).
- [27] Weblist of Epidemics Compared to Coronavirus, retrieved on March 30, 2020: <https://listfist.com/list-of-epidemics-compared-to-coronavirus-covid-19>.
- [28] S. Wolfram (2002). *A New Kind of Science*. Wolfram Media.