



Supplementary Materials for  
**Named nonhumans crossing the line**

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## Materials and Methods

### Conceptual model of the fame evolution of scientists and nonhuman protagonists

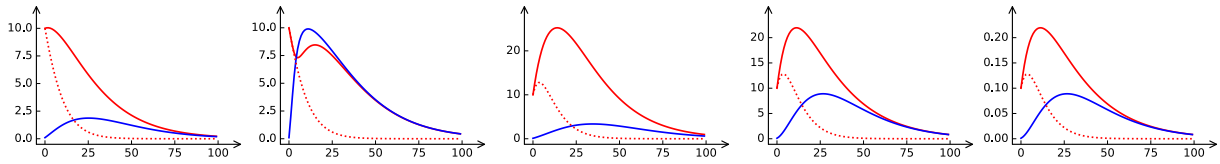
In academic community, miscellaneous nonhuman protagonists routinely fill the credit niches in scientific activities, which raise intriguing ethical questions and ushers us in a sequential dilemma. For instance, lately, the GitHub superstar Luc Esape, a bug fixing bot hiding under an assumed name to combat human's heavy bullish bias against machines, was unmasked by his host Martin Monperrus (1, 2).

Here, we propose a semiquantitative model to characterize the fame evolution of a scientist and a corresponding nonhuman protagonist, which cannot be comprehensively assessed by the well-accepted theoretical frameworks such as utility theory and reciprocal altruism. If the fame of the scientist and the nonhuman protagonist at time  $t$  is  $a_t$  and  $b_t$ , respectively, then their respective fame at time  $t+1$  can be computed as follows:

$$a_{t+1} = \left[ a_t + \frac{a_t^p}{a_t^p + b_t^p} c(a_t + b_t) \right] e^{-\lambda \frac{T+t+2}{T+t+1}},$$

$$b_{t+1} = \left[ b_t + \frac{b_t^p}{a_t^p + b_t^p} c(a_t + b_t) \right] e^{-\mu \frac{t+2}{t+1}},$$

where  $\lambda$  and  $\mu$  are decay parameters,  $c$  is a parameter that controls the increase in fame, and  $p$  reflects whether the fame increase accrues to the scientist or the nonhuman protagonist.  $T$  represents the time interval between the fame tipping point of the scientist and the nonhuman protagonist. The initial values  $a_0$  and  $b_0$  are constants, where the magnitude of  $b_0$  is smaller than that of  $a_0$ . These conceptual representations promise to reveal the dynamic fame evolution of a scientist according to the perceived utility of collaborative interaction with a corresponding nonhuman protagonist in contexts with minimal differences.



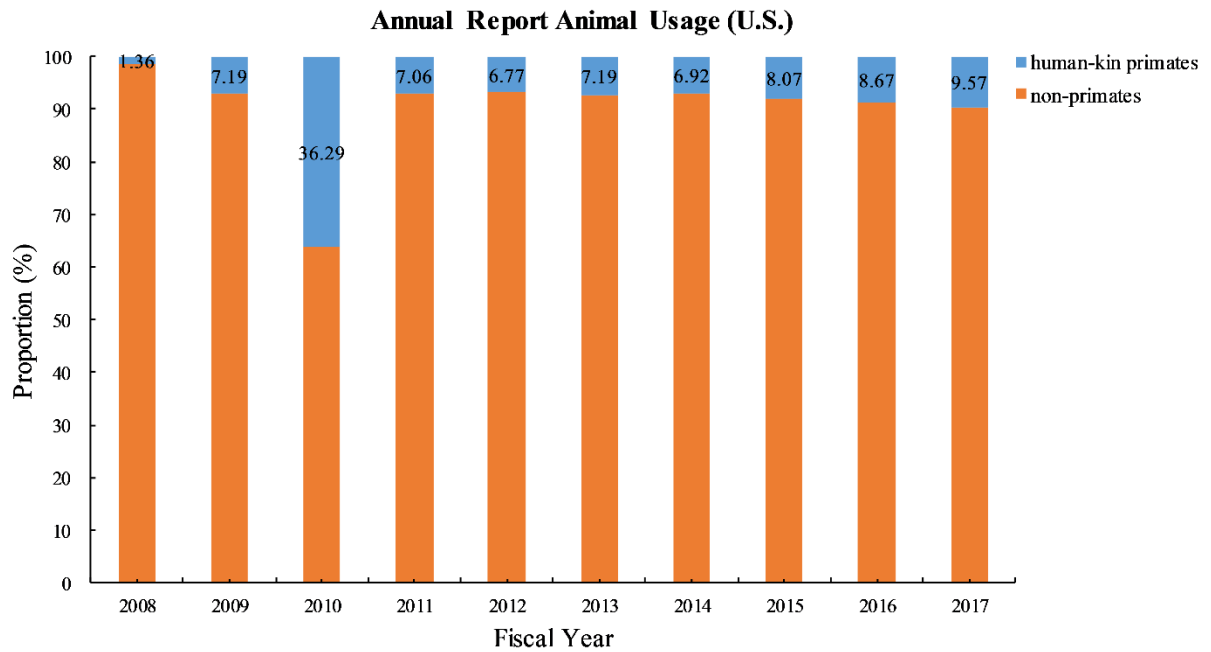
(a) high  $T$ , high  $p$  (b) high  $T$ , low  $p$  (c) low  $T$ , high  $p$  (d) low  $T$ , low  $p$  (e) low  $T$ ,  $p$  and  $a_0$

**Schematic diagrams of dynamic fame trajectories in several representative scenarios.** The blue line indicates the fame of a nonhuman protagonist, the dotted red line indicates the fame of a scientist without the corresponding nonhuman protagonist, and the solid red line indicates the aggregate fame of the scientist and the nonhuman protagonist. Panel (a) shows that the fame of the nonhuman protagonist can slow the decay of the scientist's fame. Panel (b) shows that the fame of the scientist may be suppressed after the nonhuman protagonist's fame subsides if the nonhuman protagonist attracts most of the attention. Panels (c) and (d) show that the nonhuman protagonist helps the scientist gain more fame. Panel (e) shows that the fame of the nonhuman protagonist may also be limited if the scientist has low initial fame.

## References

1. M. Monperrus *et al.*, “Human-competitive Patches in Automatic Program Repair with Repairnator” (2018)(available at <http://arxiv.org/abs/1810.05806>).
2. M. Monperrus, in *2019 IEEE/ACM 1st International Workshop on Bots in Software Engineering (BotSE)* (IEEE Press Piscataway, NJ, USA, Montreal, Quebec, Canada, 2019; <https://ieeexplore.ieee.org/document/8823632/>), pp. 12–15.
3. Z. Hu, Y. Cui, J. Zhang, J. Eviston-Putsch, Shalosh B. Ekhad: A Computer Credit for Mathematicians. *Scientometrics* (2019), doi:10.1007/s11192-019-03305-7.
4. J.-B. Michel *et al.*, Quantitative Analysis of Culture Using Millions of Digitized Books. *Science* **331**, 176–182 (2011).
5. Charles Lamb’s Elia. *North Am. Rev.* **100**, 284–287 (1865).

**Fig. S1.**



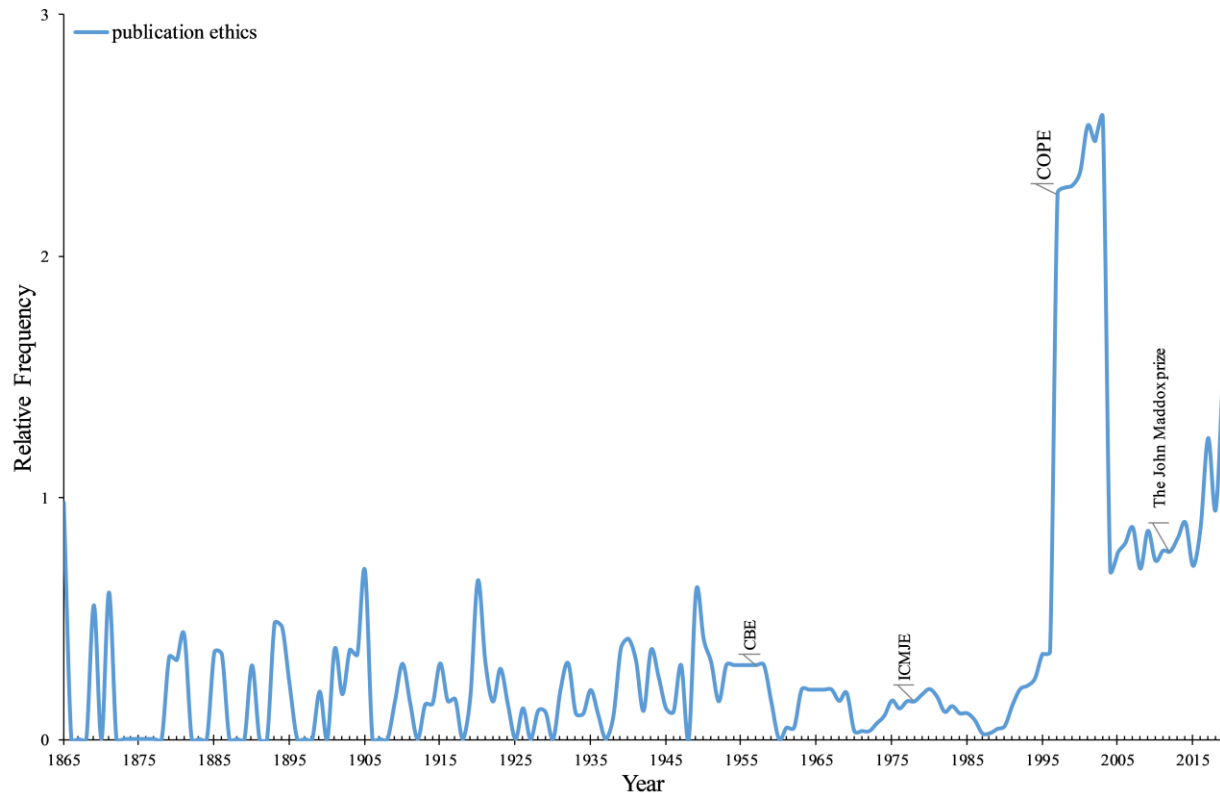
**Fig. S1 | Annual Report Animal Usage in the U.S. by Fiscal Year 2008-2017.** (Data Source: Animal and Plant Health Inspection Service, United States Department of Agriculture ([https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA\\_Obtain\\_Research\\_Facility\\_Annual\\_Report](https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA_Obtain_Research_Facility_Annual_Report)))

**Fig. S2.**



**Fig. S2 | Doron Zeilberger and Shalosh B. Ekhad (Courtesy of Doron Zeilberger).** Zeilberger's first UNIX 3B1 personal computer, AT&T 3B1, is named after its model number in Hebrew ("Shalosh" and "Ekhad" mean "Three" and "One" in Hebrew, respectively). Ekhad not only had at least 24 articles in the Web of Science (WoS), 53 articles on arXiv, and 5 online webBooks but also had its own official homepage and even a personal journal, *The Personal Journal of Shalosh B. Ekhad and Doron Zeilberger*. Ekhad published 77 articles on the personal journal (3).

**Fig. S3.**



**Fig. S3 | Diachronic discourse of the *lingua franca* ‘publication ethics’ between 1865 and 2019.** To facsimile the pragmatic patterns of issued publications in English journals and books, this dynamic trajectory is orchestrated by the metadata of JSTOR, Google Books Corpus (GBC)(4), and Web of Science (WoS). This finding promises to articulate the unfolding chronological nature of publication ethics. As early as in 1865, an anonymous critical notice concerned about the reprint issues of deceased author (5). In retrospect, many leading publishers and dynamic communities such as the Council of Biology Editors (CBE)(1957), the International Committee of Medical Journal Editors (ICMJE)(1978), and the Committee on Publication Ethics (COPE)(1997) worked together to standardize the publication ethics and offer guidance to authors. In 2012, the John Maddox prize, named for the former editor-in-chief of *Nature*, is awarded to scientists who defend sound science against the publish-or-perish trend.

**Table S1.**

**Table S1** Chronological list of several representative nonhuman authors credited in the scientific literature\*.

Year	Category	Credited name	Publications
1975	pet Siamese cat	F.D.C. Willard (ca. 1968–1982)	Hetherington, J. H., & Willard, F. D. C. (1975). Two-, Three-, and Four-Atom Exchange Effects in bcc $^3\text{He}$ . <i>Physical Review Letters</i> , 35(21), 1442–1444. <a href="https://doi.org/10.1103/PhysRevLett.35.1442">https://doi.org/10.1103/PhysRevLett.35.1442</a>
1978	pet dog	Galadriel Mirkwood	Matzinger, P., & Mirkwood, G. (1978). In a fully H-2 incompatible chimera, T cells of donor origin can respond to minor histocompatibility antigens in association with either donor or host H-2 type. <i>Journal of Experimental Medicine</i> , 148(1), 84–92. doi:10.1084/jem.148.1.84
1980	pet Siamese cat	F.D.C. Willard (ca. 1968–1982)	Willard, F. D. C. (1980). L'hélium 3 solide: un antiferromagnétique nucléaire. <i>La Recherche</i> , 114, 972–973.
2000	<i>Felis catus</i>	Moe Gregory	Gregory, T. R. (2000). Nucleotypic effects without nuclei: Genome size and erythrocyte size in mammals. <i>Genome</i> , 43, 895–901. doi:10.1139/g00-069
2001	pet hamster	H.A.M.S. ter Tisha	Geim, A. K., & ter Tisha, H. A. M. S. (2001). Detection of earth rotation with a diamagnetically levitating gyroscope. <i>Physica B: Condensed Matter</i> , 294–295, 736–739. doi:10.1016/S0921-4526(00)00753-5
2007	bonobo	Kanzi Wamba (October 28, 1980-), Panbanisch Wamba, Nyota Wamba	Savage-Rumbaugh, S., Wamba, K., Wamba, P., & Wamba, N. (2007). Welfare of apes in captive environments: comments on, and by, a specific group of apes. <i>Journal of Applied Animal Welfare Science</i> , 10(1), 7–19. doi:10.1080/10888700701277261
2012	pet cat	M. Pucci (legal name, Kitty- Witty)	Pucci, M., & Troian, S. M. (2012). Thermal resistance and temperature jumps at liquid/solid interfaces: insights from molecular dynamics simulations. <i>APS Division of Fluid Dynamics (Fall) 2012</i> , 57(17).

\*Note: Here, the chronological list is just an exemplificative collection.

**Table S2.**

**Table S2** Chronological list of example publications with zero citations in the Web of Science.

#	Publication Year	References	Document Type
1.	1981	The Ethics of Medical Publishing: Prior Publication and Full Disclosure by Authors. <i>Annals of Internal Medicine</i> , 94(3), 401–402. doi:10.7326/0003-4819-94-3-401	Editorial
2.	1999	Committee on publication ethics (COPE). <i>British journal of ophthalmology</i> , 83(11), 1214–1214.	Material News Item
3.	1999	“Leave fossile energy to others” Belgian bishops and nuclear power. <i>ATW: Internationale Zeitschrift fur Kernenergie</i> , 44(12), 719.	Article
4.	2000	Committee on Publication Ethics. <i>British Journal of Surgery</i> , 87(1), 6–7. doi:10.1046/j.1365-2168.2000.01377.x	Editorial Material
5.	2000	Committee on publication ethics: the COPE report 1999 - Guidelines on good publication practice. <i>Occupational and environmental medicine</i> , 57(8), 506–509.	Editorial Material
6.	2000	Committee on publication ethics - Guidelines on good publication practice (Reprinted from The COPE Report, 1999). <i>British journal of surgery</i> , 87(10), 1287–1287.	Reprint
7.	2006	How nursing ethics as a subject changes: An analysis of the first 11 years of publication of the Journal Nursing Ethics - Comment (Reprinted from Bulletin of Medical Ethics, <i>Nursing Ethics</i> , 13(1), 86–86. doi:10.1191/0969733006ne851xx	Reprint
8.	2007	PLoS Medicine’s Advisory Group on Publication Ethics. <i>PLoS Medicine</i> , 4(2), e81. doi:10.1371/journal.pmed.0040081	Editorial Material
9.	2007	MENC research publication/presentation Code of Ethics. <i>Journal of Research in Music Education</i> , 55(4), 376–377. doi:10.1177/0022429408318953	Article
10.	2010	COPE (Committee of Publication Ethics). <i>Korean journal of orthodontics</i> , 40(1), 1–2.	Editorial Material
11.	2010	Consensus Statement on the Adoption of the Committee on Publication Ethics (COPE) Guidelines. <i>Journal of Surgical Education</i> , 67(4), 274. doi:10.1016/j.jsurg.2010.06.011	Editorial Material
12.	2014	General Editorial on Publication Ethics. <i>Sadhana</i> , 39(1), 1–1. doi:10.1007/s12046-014-0241-x	Editorial Material
13.	2015	Editorial Council; editorial team; Edition; Founders; publisher; publishing ethics; Contact details; minimum system requirements for accessing the publication; Schedule of publication. <i>Nanotehnologii v stroitel'stve</i> , 7(3), 10–14.	Editorial Material
14.	2015	Editorial Council; editorial team; Edition; Founders; publisher; publishing ethics; Contact details; minimum system requirements for accessing the publication; timetable for publication. <i>Nanotehnologii v stroitel'stve</i> , 7(5), 11–15.	Editorial Material
15.	2015	General editorial on publication ethics. <i>Pramana</i> , 84(1), 1–2. doi:10.1007/s12043-014-0923-2	News Item
16.	2015	Looking for shortcuts. Lack of ethics in publications. <i>RqR Enfermería Comunitaria</i> , 3(1).	Editorial Material
17.	2016	Media Education Journal: Publication Ethics and Publication Malpractice. <i>Mediaobrazovanie-Media Education</i> , (1), 186–186.	Editorial Material
18.	2016	General editorial on publication ethics. <i>Journal of genetics</i> , 95(1), 1–1.	Editorial Material
19.	2017	Journal of Materials Engineering and Performance Plagiarism Policy To be Used in Conjunction with the Current “Publication Ethics” Statement. <i>Journal of Materials Engineering and Performance</i> , 26(1), 2–3. doi:10.1007/s11665-016-2479-4	News Item
20.	2017	General Editorial on Publication Ethics. <i>Resonance</i> , 22(1), 1–2.	Editorial Material
21.	2017	Proposed Amendments to the AOA Constitution, Bylaws, and Code of Ethics. <i>The Journal of the American Osteopathic Association</i> , 117(6), 353–358. doi:10.7556/jaoa.2017.072	Editorial Material