Misfortunes never come singly: Reflections of the environment in a proverb

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Abstract

“Misfortunes never come singly” is a saying common in different languages and historical contexts. Could this proverb reflect more than irrational superstitions? We draw from two frameworks, the fast-and-frugal heuristics approach to decision making, and the rational analysis of cognition. The former prompts us to conceptualize the proverb as a simple but smart heuristic that may be adapted to statistical regularities in decision-making environments, and the latter offers a method for studying such environments. Analyzing the pattern of humanitarian disasters between 2000 and 2022, we find that the probability of observing a new disaster in a country increases with the frequency of new disasters observed in the previous 100 days in that country. We propose a research agenda to study the ecological rationality of proverbs. Our results are also potentially relevant to humanitarian analysts.

Keywords: Humanitarian decision-making; rational analysis; heuristics; proverbs; Misfortunes never come singly.

Misfortunes never come singly!

In English, a popular saying goes “misfortunes never come singly”, and another states “when it rains, it pours” suggesting that mishaps might come serially, and one disaster could turn into a larger one. English is not the only language that knows such proverbs. For instance, a German idiom stipulates that “a disaster comes seldomly alone” (*Ein Unglück kommt selten allein*), and so does a French (*Un malheur n'arrive jamais seul*) and a Spanish one (*Las desgracias nunca vienen solas*). The ancient Greeks may also have had their variant of the same expression: Describing how Aias fought against the Trojans, the Illiad resumed, “…every way evil was heaped upon evil” (Homer, n.d.; Centro Virtual Cervantes, 2024). Could those expressions reflect more than irrational superstitions?

In 1919, the Biologist Paul Kammerer published a book, titled “*The law of seriality: A study of repetitions of events in life and the world coincidences*”. Kammerer (1919) started out with the German variant of the proverb. Allegedly praised by Albert Einstein and commented upon by Sigmund Freud, “The law of seriality” was an unpardonable transgression of scientific rigor to others: because Kammerer had published *that* book, a commission of professors from his faculty refused to appoint him professor (Hirschmüller, 1991).

We examine whether the proverb “misfortunes never come singly” could nevertheless reflect scientific insights. To this end, we bring together two frameworks: the *fast-and-frugal heuristics approach* (Gigerenzer, Todd, & the ABC Research Group, 1999); and the *rational analysis of cognition* (Anderson, 1991). Both reflect a key idea of Herbert Simon (1956), namely that rationality is ecological: cognitive mechanisms and the structure of the environment shape, together, behavior and performance. Simon (1990) expressed this idea with the metaphor of the two interlocking blades of a scissor. The fast-and-frugal heuristics approach provides us with a framework for conceptualizing the mental blade, and the rational analysis with a method to empirically study the environmental blade. Our thesis is this: the proverb is a rule of thumb for rational decision-making that is adapted to a world where disasters may, indeed, occur in series.

We focus on major disasters as they can hit entire populations. In this domain, our thesis has practical relevance. A key task of humanitarian analysts is to anticipate future disasters. If accurate, such predictions can save lives, because they can inform decisions such as where to stockpile food and medication or deploy staff and send aid.

The fast-and-frugal heuristics framework

The fast-and-frugal heuristics framework (see Gigerenzer & Gaissmaier, 2011, for an overview) posits that humans and other animals come equipped with a toolbox of rules of thumb, dubbed *fast-and-frugal heuristics*. Each heuristic is adapted to specific task environments. By choosing heuristics that match the environment, agents can make accurate, fast, or otherwise adaptive decisions. The term *ecological rationality* (e.g., Goldstein & Gigerenzer, 2002) refers to that fit between a decision-makers’ goals, their heuristics, and environments. Indeed, in several real-world environments, heuristics have been found to allow agents to make more accurate predictions than more complex information-greedy tools such as regressions or machine learning algorithms (e.g., Czerlinski et al., 1999; Gigerenzer & Brighton, 2009).

Heuristics in humanitarian decision-making?

Heuristics have been studied in medicine, military, finance, and other fields (e.g., Katsikopoulos, Simsek, Buckmann, &

In L. K. Samuelson, S. L. Frank, M. Toneva, A. Mackey, & E. Hazeltine (Eds.), *Proceedings of the 46th Annual Conference of the Cognitive Science Society.*

Gigerenzer, 2020). Beyond helping make accurate predictions, heuristics have three other qualities that could make them ecologically rational humanitarian analysis tools.

First, heuristics provide decision processes that require little information and computation. Second, because they are simple, heuristics are transparent: the decision processes they prescribe are understandable. Two core humanitarian values are humanity and impartiality (European Commission's Civil Protection and Humanitarian Aid Operations department, 2024). Whereas the former can call for fast reactions to disasters to limit the number of people affected, the latter prescribes treating all individuals equally, without discriminating among them. Speed, frugality, and transparency may aid to reach those goals.

Third, in practice, those two values can clash, particularly because different regions or populations compete for scarce humanitarian aid, and the impartial, objective 'calculation' of need is often equated with extensive data collection and analysis (e.g., Glasman, 2020). The science of heuristics offers another perspective on what is required to act impartially, namely by distinguishing between *risk* and *uncertainty* (Knight, 1921) and the tools for those two classes of environments (see Hafenbrädl Waeger, Marewski, and Gigerenzer; 2016): Under risk, all alternative courses for action are known or knowable, and so are their consequences, and respective probabilities of occurring. Tools for risk are optimization (e.g., utility-maximization, Bayesian) approaches that can, by considering all information, point to the best option. Under uncertainty, the available information is limited and/or not fully reliable (e.g., not all consequences are known, probabilities cannot be reliably estimated). Under uncertainty, guiding principles and normative benchmarks for behavior are heuristics and their fit, respectively, to the environment. Humanitarian decision-making is fraught, like most real-world domains, with uncertainty. Hence, the philosophy behind establishing humanitarian need in an impartial way appears better suited to follow ecologically rational heuristics than optimization approaches.

From an idiom to a fast-and-frugal heuristic?

Many heuristics are specified as algorithmic, computational models, which allows researchers to study and measure their performance (e.g., in computer simulations) as well as to find out what statistical structure in environments each heuristic is adapted to. The proverb we study here is not a precisely specified model but a qualitative statement.

Yet, in that regard, "Misfortunes never come singly" is no different from other qualitatively cast heuristics practitioners may use. One such heuristic is "First listen, then speak" (Gigerenzer, 2014, *p*. 117), a simple rule for leadership; other examples abound (e.g., in business strategy; Bingham & Eisenhardt, 2011). Conversely, certain computationally specified heuristics may have their qualitative equivalents in idiomatic or natural language. Consider the popular saying to "not put all eggs in the same basket", which has, in fact, been conceived of as a heuristic, notably in entrepreneurial decision-making (Manimala, 1992). The wisdom behind that proverb is captured by equal-weighting heuristics for inference such as *tallying* (e.g., Gigerenzer & Goldstein, 1996; Dawes, 1979) and the investment strategy, *1/N,* that is diversifying one's portfolio (DeMiguel, Garlappi, & Uppal, 2009; Artinger, Petersen, Gigerenzer & Weibler, 2015).

One way to uncover how the proverb "Misfortunes never come singly" could be computationally specified in models involves understanding the structure of decision-making environments to which the proverb could be applied. That is, one may try to start to understand the mental blade by looking at its counterpart, the corresponding environmental blade (Marewski, Katsikopoulos, Guercini, in press). The idea is that the mental blade must interlock cleanly with the environmental blade to be effective. Here, the rational analysis of cognition comes into play.

The rational analysis of cognition

Asking whether "the output of…cognition [can] be predicted from the assumption that it is an optimal response to the information-processing demands of the environment", Anderson (1991, *p*. 471; see also Anderson & Milson, 1989) developed the rational analysis as methodology to understand the workings of cognitive mechanisms "from the statistical structure of the environment" – as opposed to from "the assumed structure of the mind" (*p*. 471). He (1991) applied the analysis to memory, categorization, causal inference, problem-solving, and others have extended this line of work since then (e.g., Chater & Oaksford, 1999).

Of particular interest for our purposes is Anderson and Schooler's (1991) analysis of how human memory retrieval might reflect the temporal pattern of occurrence of information in the world, as well as a follow-up study that asked a similar question for chimpanzee memory (Stevens, Marewski, Schooler, & Gilby, 2016a). As a first step towards a rational analysis of "Misfortunes never come singly", we borrow from those studies by analyzing humanitarian informational environments in a way that is analogous to those authors' analyses of other informational environments.

Informational environments

One can summarize the rational analysis in four iterative, repeatable steps to develop a model of cognitive mechanism (Anderson, 1991; Stevens et al., 2016a).

Table 1: Rational Analysis

Steps
1. Describe the goals a cognitive mechanism must achieve.
2. Describe the structure of the environment in which the mechanism must achieve its goals.
3. Describe the constraints that may act on the mechanism.
4. Describe what candidate processes would produce an optimal response to achieve the goal (1), giving the environmental structure (2) and constraints (3).

To illustrate, a goal that the memory system must achieve is to retrieve information that is relevant, given an environmental cue (e.g., when reading the words 'space shuttle Challenger', recalling the disaster). Information storage and retrieval happens in the context of an environment that exhibits predictable statistical regularities, characterized, for instance, by linear and power laws.

Figure 1 shows analyses of such regularities, as they were conducted by Stevens et al. (2016a), building on earlier analyses by Anderson and Schooler (1991), and Pachur, Schooler and Stevens (2014). Panel A illustrates the pattern of contacts between wild chimpanzees over a 30-day period. Panel B shows the linear relation between the frequency, *n*, of past contacts (here: in the past 15 days) and the probability that a pair of chimpanzees will be in contact again in future (here: on day 16). Panel C shows the corresponding power law for the recency of past contacts, measured in time, *t* (here: days), since the last contact, and the probability of future contacts (here: on day 16).

Consider, for example, the linear relation between past frequency of contact occurrence and probability, *Pr*, of future occurrence. *Pr* can be empirically estimated as the proportion of how often a pair of chimpanzees that had contact *n* times in during a 15-day window, re-encountered each other on day 15+1. Stevens et al. (2016a) found that the probability of a contact on day 15+1 reflected the proportion of past contacts in the previous 15 days with $Pr=.14+.05n$.

Similarly, Anderson and Schooler (1991) found the probability of a word re-occurring in speech to a child on day 100+1 as a function of its occurrences in the previous 100 days was $Pr=.00+.0076n$; and that probability was $Pr=.00+.009n$ for receiving emails as a function of prior messages received. That is, if those objects occurred in a proportion, *P*, of the past 100 instances, they had probabilities of .76P and .9P, respectively, of occurring in the next instance (Anderson & Schooler, 1991; *p*. 402). Similar statistical regularities have been found in other informational environments such as the occurrence of words in the New York Times, and contacts between humans (e.g., Stevens et al., 2016a; Pachur et al., 2014; see also Simon, 1955).

Given such stable environmental patterns, and memory constraints (e.g., limited storage), how could optimal memory (e.g., retrieval) processes look, is a question further modeling work addressed (e.g., Schooler & Anderson, 1997), ultimately resulting in the Bayesian memory model of the *ACT-R cognitive architecture* (e.g., Anderson et al., 2004).

Towards the rational analysis of a proverb

Rather than using rational analysis to develop a theory of memory or other capacities, we propose to use it to develop models of heuristics from proverbs. The research agenda follows steps 1-4 (Table 1); albeit replacing *optimal* with *ecologically rational* in step 4.

Anticipating future disasters may be an important task not only for humanitarian analysts but for any human decision-maker. For instance, once a natural catastrophe has struck or a war or infectious disease has broken out, a decision may be: Should my family and I (or e.g., analogously: should our entire tribe) leave our home (or e.g., analogously: our homeland) to settle elsewhere?

One may speculate that related questions (e.g., patch-leaving: Hutchinson, Wilke & Todd, 2008) may have re-occurred with regularity in human evolution, letting one wonder to what extent natural selection could have shaped corresponding decision-making mechanisms. However, even though a rational analysis may be informed by evolutionary considerations (Anderson, 1991), we do not aspire to embrace an evolutionary perspective, and indeed most rational analyses have not done so either (Stevens et al., 2016a). For instance, a complementary thesis may be that the proverb "Misfortunes never come singly" has emerged through cultural learning.

There are several ways the proverb "Misfortunes never come singly" could be cast into models. The simplest – heuristics – could operate on knowledge of the frequency of past disasters, their recency, or both. Other computational implementations of the proverb or of alternative mechanisms may take more complex forms. The study of the ecological rationality of heuristics requires benchmarking their performance against that of other models (e.g., Gigerenzer & Brighton, 2009). Hence, step 4 would include competitive model tests, examining how well different computational implementation of the proverb as well as competing models allow achieving the goals specified in step 1.

Moreover, in line with the notion of bounded rationality (e.g., Simon, 1956) any decision-making mechanism – be it heuristic or other – would be examined with respect to its ability to cope with limitations of human information-processing capacities, knowledge, and time. Such an analysis may need to model the interplay of decision-making mechanisms with other components of cognition, notably memory (e.g., Marewski & Schooler, 2011). Memory will shape, for example, what past disasters a person recalls. Such memories do not need to center on one's own prior mishaps; also stories of disasters experienced by others that a person could recall could serve decision-making. Here, we leave such subtleties and the corresponding steps of the rational analysis for future research, and focus on exploring step 2, that is describing the structure of the environment to which any computational implementation of the proverb – and any corresponding competing model – must fit.

Regularities in humanitarian disasters?

Imagine a region struck by an earthquake. As an immediate consequence of that natural disaster, people die buried in their homes. But the tragedy does not end there: unburied cadavers start to breed infectious diseases, and those sickened and eventually killed are missed when it comes to taking care of crops, repairing waterlines and other infrastructure. The consequences: famine and eventually social unrest. Both eventually lead to mass migration, and violent conflict.

While the example above is fictional, it is easy to find evidence of such cascading effects. For instance, the Statute of Laborers, dating from medieval England (1351), describes how the disaster caused by the plague – massive death – resulted in new mishap (e.g., Little, 2007):

> "Because a great part of the people and especially of the, workmen and servants has now died in that pestilence, some, seeing the straights of the masters and the scarcity of servants, are not willing to serve unless they receive excessive wages, and others, rather than through labour to gain their living, prefer to beg in idleness."

Reviewing the historical literature, Hays (2007) provides a summary of potential spillovers of an earlier plague from the time of the east-Roman emperor Justinian in the 6th century AD. This plague may have led, for instance, to a decrease of trade, production, and eventually statal power.

Or consider the Comanche, a native American people who forged an empire on the Great Plains that kept other native American peoples at bay, as well as the Spanish, Mexican, and later Texans, blocking and even inverting the European expansion on the North American continent (Hämäläinen, 2010). Their empire was characterized by military and commercial prowess. The Comanche traded with, and coercively extracted resources from their neighbors; for instance, they were able to raid for horses and slaves deep into the Mexican tropics, stopping only about 200 km short of Mexico City (Hämäläinen, 2012). As Hämäläinen (2010) describes, "By the 1810s Comanches were treating the Spanish Southwest like a colonial possession" (*p.* 191). But then, in the mid-1840s a lasting drought affected two resources on which the Comanches' empire rested, the bison and the horse, which both compete for similar ecological niches (Hämäläinen, 2010, 2012). Hämäläinen (2010) describes the succession of disasters (*pp.* 205-206):

> "Half of Comanchería's seven million bison may have perished, leaving the Comanches reeling. Famine left them exposed to disease, and they were struck by cholera in 1849 and smallpox in 1848, 1851, and 1861. By the early 1860s, the Comanches had lost more than half their numbers and, with that, their power to command. They surrendered their raiding domains, gave up tribute extraction, and witnessed their commercial pull dissipate to almost nothing."

Such cascading effects are also apparent in modern-day environments, sometimes stunningly echoing the past. For instance, challenges to authorities (e.g., resistance against quarantine rules) and social turmoil surfaced during the Covid-19 pandemic (e.g., for Germany see Plümper, Neumayer & Pfaff, 2021). In 17th century plague-stricken Italy, popular opposition (e.g., to pest houses, isolation) and corruption came with the black death (Hays, 2007). And they are studied for different geographical locations, and from the perspective of different disciplines, including history, economics, and medicine. For example, adopting what they call a "multi-shock" framework, Lazzaroni and Wagner (2016) use an econometric model to estimate how shocks in purchase prices and droughts impact on child health in Senegal. Similarly, Échevin and Tejerina (2013) study shocks in San Salvador. In the *The Lancet Infectious Diseases,* Oxford et al. (2002), in turn, suggest that the 1918-1919 influenza pandemic that led to 40 million dead, may have had an origin in the trenches of World War I.

In short, although it is plausible that different types of social and biological cascading effects could cause statistical regularities in the pattern of disasters, it is also possible that other causal pathways shape the pattern of disasters. The rational analysis does, in fact, not specify the causal pathways – the question of interest is the nature of the patterns; that is, by what statistical laws they can be described.

One possibility is that statistical regularities in natural and human disasters resemble those linear and power relationships found for other environments (e.g., Anderson & Schooler, 1991; Stevens et al., 2016a). Other lawful relations, such as exponential functions, are also a possibility. Yet another possibility is that the (e.g., historical) examples of chains of disasters do not reflect broader, regular patterns. If there were no lawful statistical patterns to disasters, then the proverb, "misfortunes never come singly", would, after all, solely belong to the realm of superstition.

Methods

Data

Our disaster data has been extracted from EM-DAT, *The International Disaster Database compiled by the Centre for Research on the Epidemiology of Disasters* on January 30th, 2024. EM-DAT includes observations on "over 26,000 mass disasters worldwide from 1900 to the present day…EM-DAT defines disasters as situations or events which overwhelm local capacity, necessitating a request for external assistance at the national or international level. Disasters are unforeseen and often sudden events that cause significant damage, destruction, and human suffering" (EM-DAT, 2024a, b).

We consider 13,148 disasters from January 1st, 2000, until December 31st, 2022, for a total of 221 countries or territories, categorized under 31 natural or technological disaster types. The resulting matrix thus covers 8,401 days, containing a total of 1,856,620 cells, coded as 1 (=new disaster observed) or 0 (=no new disaster observed).

In this first exploratory analysis, we do not distinguish between different causes for non-reporting, including the possibility that a disaster actually did occur, but never made it into the data base. Also, to facilitate the analysis with binary coding, we collapse cases of multiple disasters in a given country on a given day to a single disaster.

Analysis

Adapting R-code from Stevens et al. (2016b), and following Anderson and Schooler (1991), we estimate (a) how well the frequency of past disasters, n, in the previous m days predicts the probability, Pr, that a disaster is observed on day $m+1$, and (b) how well the passing of time, t, predicts the probability that a disaster is observed on day $m+1$. As Anderson and Schooler did, we set m to 100 and measured t in terms of the number of days that have elapsed since the last disaster in that time window of m days was observed.

Specifically, using a moving window of 100 consecutive days, we identified 1,834,521 windows. For each 100-day window, we counted the number of disasters in a country, *n*, over the first 100 days. For each instance of *n* disasters, we estimated the probability of a disaster being observed on day 101 as proportion of all days 101.

Moreover, we computed the probability of a disaster being observed in a country on day 100+1, based on the number of consecutive days, *t*, that have elapsed since the last disaster during that window of 100 days. The maximum recency of 100 days was used to match the frequency data and resulted in 589,309 recency events.

We fitted a linear regression to the frequency data, and a power function to the recency data. Adapting code from Stevens et al. (2016b) and published in Dryad Data Repository (http://datadryad.org/), we used binomially distributed maximum-likelihood estimation.

Our analysis used R v. 4.3.2 (R Core Team, 2023), bbmle (Bolker & R Development Core Team, 2023), car (Fox & Weisberg, 2019), Hmisc (Harrell, 2023), Rcpp (Eddelbuettel et al., 2023) and tidyverse (Wickham et al., 2019).

Results

Figure 1D illustrates the disaster data, focusing on a selected sample of six countries and a period of 8,401 days, ranging from 1 January 2000 to 31 December 2022. Turning to the complete data set, Figure 1E shows the probability of disaster being observed on day 100+1, depending on the frequency of disasters in the previous 100 days. Figure 1F shows the probability of observing a disaster on day 100+1 as a function of how many consecutive days have passed since the last disaster in that 100-day time window.

As Figures 1A and 1D illustrate that chimpanzee meetings and disasters occur on a different timescale: some countries go years without a disaster. Yet, if a disaster is observed, then the probability that another one will be observed within the next 100 days starts to rise (Figure 1E). As the number of disasters observed within 100 days increases, so does the probability that disaster will strike again in proximity. As the saying goes: when it rains, it pours.

Conversely, the probability that a new disaster will strike drops steeply as the number of days elapse since a previous disaster was observed (Figure 1F). Soon enough, the probability of observing a new disaster drops to a low level and decreases only subtly thereafter. This suggests that even after torrid run of storms comes, the sun will shine, at least until the next bout of misfortune hits again.

Towards a research program on proverbs as ecologically rational heuristics

The United Nations Global Humanitarian Overview (2023) emphasizes how important the tasks of anticipating and responding to humanitarian disasters are in a world rocked by climate change, wars, and forced displacements.

In this article, we showed one way of developing decision-making tools for anticipation. Yet, a corresponding research agenda may not only contribute to the humanitarian practice, but also shed light on the adaptive nature of proverbs, the statistical characteristics of environments to which they may be adapted, and in so doing, expand research on heuristics and the rational analysis to domains that are under-studied within those two frameworks: humanitarian decision making, and folk wisdom, respectively.

Indeed, modelling the statistical properties of disaster environments is particularly important given that multiple proverbs may fit different disaster environments, or the same environment in different ways. Sayings like “misfortunes never come singly” are often mirrored by antonymous proverbs (see e.g. Mieder, 2004). In our case, candidate antonyms may include “lighting never strikes the same place twice” or “it is always darkest before the dawn”.

Further, corresponding research does not need to be limited to humanitarian disasters. The proverb „Misfortunes never come singly” is used to refer to different situations in life, including mishaps that concern single individuals. A characteristic of certain individual situations maybe that the agent is in control, at least, partially. In humanitarian disasters, many agents are involved, and natural disasters such as earthquakes are fully out of human control, whereas human-made ones (e.g., wars) may rarely be the product of the action of a single person, lest be controllable by one agent.

It is, likewise, an open question if related, but distinct idioms capture other regularities in the world. For example, could expressions such as “Es ist wie verhext“ (“It’s like a bewitchment”) fit to fully unpredictable environments? Or consider Murphy’s law, which originates in modern areo-space engineering rather than in an ancient idiom, but which is applied, nowadays, as catchphrase in other domains (e.g., finance: Kirilenko & Lo, 2013). To what statistical properties of environments does this modern-day saying, “Anything that can go wrong will go wrong”, adapt?

In terms of limitations, we arbitrarily applied a window size of 100 days. Capping our window at 100 days may preclude the possibility of identifying structures that inform other proverbs guiding decisions about early recovery, such as when to count the costs and start re-building.

Additionally, the focus of our proverb, “misfortunes” can be construed liberally, as we do here by collapsing all EM-DAT disaster types into a binary variable. Yet disasters may be more precisely defined and compared based on scale, severity, magnitude, or other features, depending on the goal at hand (see e.g. Otrachshenko et al., 2018). Lighting may never strike the same exact “place” – such as a tree or house – twice, but this does not necessarily mean it never strikes the same country, town, or even geographic coordinates again.

Conclusion

The mathematician Polya (1945) linked heuristics to the “wisdom of proverbs” (*p.* 132). It was also Polya’s notion of heuristics that inspired the science of computational models of heuristics, developed by Newell and Simon in the 1950s, converging into Simon’s notion of bounded rationality, and leading into the fast-and-frugal heuristics framework (e.g., Dick 2015). Newell, in turn, later became known for pushing for an integrative view on the cognitive sciences, fulminating into architectural models of cognition, a paradigm into which rational analysis belongs. Indeed, the research agenda we propose is one of connecting dots in multiple ways.

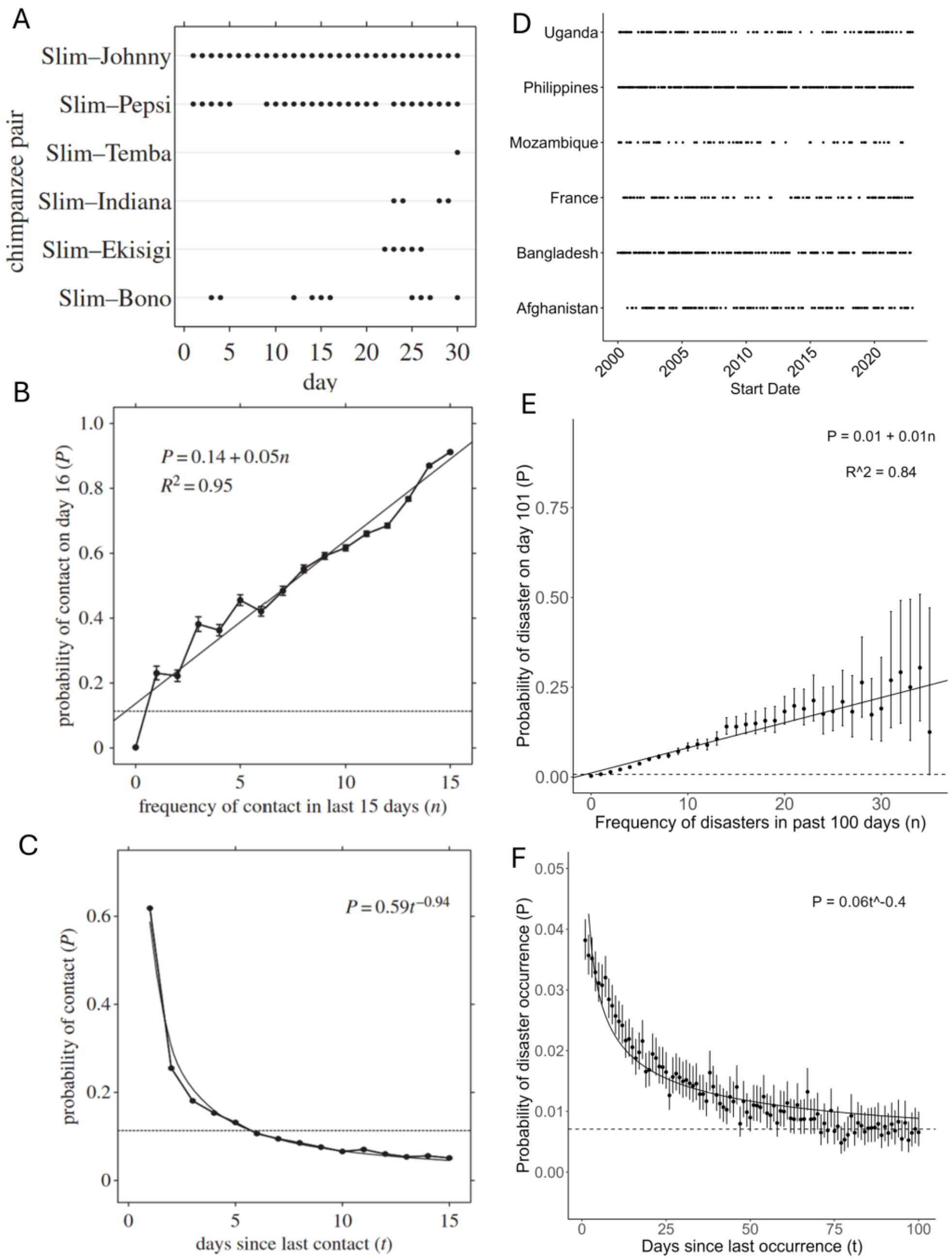

Figure 1: A = “Pattern of encounters between pairs of wild chimpanzees over a 30 day period” (*p.* 5); D = pattern of disasters observed between 2000-2022 (selected countries); B = “The frequency of a chimpanzee encountering a social partner in the previous 15 days predicts future contact with that partner. Errors bars show binomial 95% CIs. Dashed line represents overall mean probability of contact in the dataset” (*p.* 5); E = The frequency of a disaster occurring in the previous 100 days predicts a future disaster occurring. Errors bars show binomial 95% CIs. Dashed line represents overall mean probability of a disaster in the dataset; C = “The recency of a chimpanzee encountering a social partner predicts future contact with that partner. Error bars with binomial 95% CIs are too small to plot. Dashed line represents overall mean probability of contact in dataset. Curves illustrate best fitting power functions” (*p.* 5); F = The recency of a disaster occurring predicts a future disaster occurring. Error bars show binomial 95% CIs. Dashed line represents overall mean probability of a disaster in dataset. Curves illustrate a power function. A, B, and C reprinted from Stevens et al. (2016a) under CC BY 4.0 DEED Attribution 4.0 International license.

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