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CORRESPONDENCE

Response to Foxon's (2023) "Can Bayesian Statistics Be Used To Analyze Phenomena in Folk Zoology?"

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Foxon (2023) gave an impeccable exposition of the formalities of the Bayesian procedure. Where the probabilities of the available evidence are readily quantifiable, those formal steps can be taken. But the various kinds of evidence about "Nessies" are not precisely quantifiable as to their likelihood, so subjective estimates, quantified approximately, have to be relied upon, just as they are in applications of the Bayesian approach to medical diagnosis or in considering likely candidates for authorship of the literature conventionally attributed to Shakespeare. In those circumstances, one estimates Bayes Factors directly.

For example, concerning the sonar evidence, the Bayes Factor is the ratio of (a) the probability of obtaining such evidence if Nessies are real and (b) the probability of obtaining that evidence if Nessies are not real. That cannot be quantified, but it is surely reasonable to presume that it is much more likely that frequent sonar echoes from apparently large single targets, usually deep and often moving quite rapidly, are much more likely to be obtained if large animals are present than if they are not. The Bayes Factor for sonar evidence is strongly positive (>>1) for the existence of Nessies.

As to the eyewitness reports, my original paper explained in detail why it seems unreasonable to dismiss *all* of the eyewitness reports but suggested only a quite weak positive (>1) Bayes Factor.

As to Scottish folklore featuring legends of strange aquatic animals, one would compare the probability of these reports not being mistaken sightings stimulated by expectation with the probability that the reports are all misinterpretations and misperceptions. Watson (2011) has pointed out that such reports are more frequent from Loch Ness than from other bodies of water in Scotland, which might warrant a rather weak but >1 Bayes Factor. In any case, if Nessies are real, they will certainly have been incorporated into folk tales.

Foxon seemed to criticize things that I did not say. I did not "us[e] a Bayesian approach" to "argue . . . for high odds of Loch Ness Monsters being real." I simply argued that the existence of Nessies is the simplest explanation, to be preferred under the philosophers' criterion of Occam's Razor, for the fact that five *independent* different kinds of evidence are all compatible with the existence of these animals, whereas if they do not exist, then separate and different explanations would be needed to explain the artifacts that all simulate living creatures even though obtained by entirely different techniques. I *then* pointed out that the same conclusion could be reached by successive application of the independent evidence, as in the Bayesian protocol.

Foxon further argued against the validity of a Bayesian approach *in cryptozoology in general*, but I did not propose that. Nevertheless, the Bayesian approach is just *the explicit consideration of evidence*, something that should always be done if one tries to gain

a well-informed, evidence-based opinion about anything at all. It suits the case of Loch Ness because of the cumulation of evidence quite untypical of cryptozoology, where little, if any, evidence is typically in hand other than eyewitness reports and folklore. For Nessies, there are sonar echoes, at least one arguably unimpeachable film, a variety of surface photographs, and underwater photography with simultaneous sonar observation. As some have put it, people have been hanged on less definitive evidence.

Foxon offered a hypothetical example of "circular . . . if we assume *a priori* . . . " and refers to "authors [who] argue that the Loch Ness evidence, which includes hoaxes and cases of mistaken identity . . .". Elsewhere (Bauer & Watson, 2023) we have discussed in detail the faulty argumentation of those who insist on certainty that Nessies do not exist.

Considerations that speak against the reality of Nessies can be treated in one of two ways: in the *a priori* estimate of a prior probability or estimating the probability of individual factors that make reality unlikely. The latter include: A type of animal not known to science but featured in folklore, misidentification by eyewitnesses, and the occurrence of hoaxes. Those three factors apply to any topic in cryptozoology, so I took them into account in assigning the prior probability. Alternatively, if one wanted to consider each of those three factors as evidence against the reality of Nessies, one would have to begin with agnosticism, 50/50 odds, and a prior probability of $p = 0.5$.

The first Bayes Factor would then concern how often have animals not known to science but reported by eyewitnesses and mentioned in folklore turned out to have some basis in real creatures not yet discovered? Cryptozoologists would happily cite quite a number of folk tales of strange creatures that turned out to be plausibly based on real animals: giraffe, gorilla, platypus; perhaps the Kraken (giant squid); and "dragon" tales, at least in China, might well have originated with fossils of dinosaurs. One might also reference the discovery of previously completely unknown *aquatic* creatures (megamouth shark) or ones thought long extinct (coelacanth). If Nessies are real, they would surely be present in folk tales. So, a subjective estimate of Bayes Factor is "unlikely" but not "very unlikely."

Hoaxes, too, would occur whether or not Nessies are real — hoaxers get their kicks from deceiving and will take any opportunity for that. Maybe a Bayes Factor <1, but not by much.

As to mis-identifications, I considered that in assigning only a very low >1 Bayes Factor for the eyewitness evidence, explaining why it seems unreasonable to dismiss *all* the numerous multiple reports by independent groups of people, some of them quite conversant with pertinent environments.

In my judgment, those three would cumulate to a composite Bayes Factor corresponding to something between "unlikely" and "very unlikely", a probability of between 0.05 and 0.25, so a Bayes Factor of about 1/6, which seems reasonably conservative.

Using a prior probability of between 0. 05 and 0.25, as I did, is the same as assuming nothing *a priori* and applying a Bayes Factor of about 1/6 in view of mis-identifications, hoaxes, presence in folklore, and as yet unknown to present-day science.

It seems that the point of contention is really whether Nessies are typical of cryptozoology: Foxon treated them as such, whereas I pointed to evidence of sonar, film, and photography that is almost wholly lacking on almost all other cryptid claims.

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