IT'S CHICKEN AND EGGS AGAIN: VAGUENESS, QUASI-SPECIES, AND EVOLUTION

by

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Summary: Whether the chicken or the egg came first, is not only a mind-boggling but a substantial question. Its answer depends on the biological background theory one assumes. I review recent work on the topic (by Teichmann, Sorensen, Waller and Raatzsch) and resolve some of the disputes between these authors by borrowing from Aristotle the distinction between chicken-produced eggs and chicken-producing eggs. I then introduce the concept of a quasi-species to make explicit the vagueness involved in species-terms and prove 13 different priority-claims within a Darwinian framework.

Zusammenfassung: Was zuerst da war, das Huhn oder das Ei, das ist nicht nur eine knifflige, sondern auch eine substantielle Frage. Die Antwort hängt von der gewählten biologischen Hintergrundtheorie ab. Ich löse einige der Unstimmigkeiten zwischen neueren Arbeiten zum Thema (von Teichmann, Sorensen, Waller und Raatzsch), indem ich mit Aristoteles zwischen Eiern, die von Hühnern hervorgebracht wurden, und Eiern, die Hühner hervorbringen, unterscheide. Dann führe ich den Begriff der Quasi-Spezies ein, um die in Spezies-Begriffen enthalte Vagheit explizit zu machen und innerhalb eines darwinistischen Rahmens 13 verschiedene Prioritätsthesen zu beweisen.

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1. The Question and its Framework

Which came first, the chicken or the egg? Admittedly, this question is none of the big issues in philosophy. But, mind-boggling as it is, the question pops up again every now and then, and it definitely deserves some attention, both as a paradigm for a certain structure of questions (as Raatzsch 2001 suggests) and as an issue in the philosophy of natural kinds.

Take an arbitrary chicken. It hatched from an egg. This egg, one should suppose, has been laid by a chicken. That chicken, again, hatched from an egg that was laid, in turn, by a chicken. And so on. Is there a way out of this *regressus ad infinitum*? A first step to get a grip on the chicken-and-egg question is to realise that any answer to it hinges on the biological background theory one assumes. An Aristotelian framework, for example, would assume both eternity and constancy of biological species. Within such a framework, the question makes no sense, at least when the "first" is taken in a temporal

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sense. Within an Aristotelian framework, every chicken is preceded by an egg and every egg is preceded by a chicken. Nevertheless, Aristotle discusses in length a similar question about potencies and acts in *Metaphysics* IX 8 (cf. Jansen 2002, ch. 6), taking both temporal and non-temporal meanings of priority into account (for which cf. *Metaphysics* V 11 and *Categories* 12). The problem is posed differently within what I would like to dub the creational framework, whether inspired by Plato's *Timaeus* or by the first chapters of the book of *Genesis*. Within the creational framework, biological species are thought of as having a beginning in time, though they remain constant once they exist. Within such a framework, it is more or less conceivable that there is either a chicken unpreceded by an egg or an egg unpreceded by a chicken: God could have first created either mature chickens or else eggs containing mature embryos. Though had God chosen to start with isolated germ cells, he would have had a lot more work to do by way of miracle.

Things become more complicated, however, within the evolutionary framework, which comes in different variations, the most famous of which are the Lamarckian and the Darwinian theories. The evolutionary framework agrees with the traditional framework as far as the temporal beginning of biological species is concerned, but disagrees with it insofar as it also disposes of the constancy of species: Biological species do not only have a beginning, they also have a history, a development. Such a development, or so it seems, makes it far more difficult to contemplate the chicken-and-egg question. For in this framework, species evolve, diversify, and branch off into new species. In a word: Species loose their clear-cut borders and species terms become vague.

2. The Discussion so far

Teichmann (1991) observed that with species becoming vague, species terms become "Sorites terms". More precisely, predicates expressing species membership become Sorites predicates. Typically, "... is bald" or "... is a heap" are Sorites predicates. Anyone who has only a few hairs more than a bald man is himself bald. Anything that has only a few grains less than a heap is itself a heap. These are the common assumptions, from which the infamous Sorites paradoxes arise. In general, a predicate "F" is a Sorites predicate, if and only if the following holds: If something differs only slightly from an F, it is itself an F. Teichmann's point is that "... is a chicken" is such a Sorites predicate: "If a creature differs from a chicken in a few minute respects, then it is itself a chicken" (Teichmann 1991, 271).

The strange logic of Sorites terms now permits the construction of a 'Chicken Paradox' in a vein similar to the classical Sorites Paradoxes. Normally, we hold both of the following claims to be true:

(A) Every chicken is born of a chicken.
(B) Chickens have not always existed.

How can this be? Teichmann does not want to answer the question "Which came first?", but he tries to solve the puzzle by pointing out its origins: "[...] the puzzle derives from the semantics of 'chicken'" (Teichmann 1991, 272). That is, the puzzle arises because "... is a chicken" is a Sorites predicate.

Sorensen (1992), in a reply to Teichmann, points out the relevance of the biological background theory. If Lamarck were right, individual creatures would be able to change membership of species. In this case, Sorensen concludes, "the chicken could have come first". But if we assume a Mendelian theory of inheritance, a particular organism cannot change its species membership: once a chicken, always a chicken. Within this framework, "the transition to chickenhood can only take place between an egg-layer and its egg". Thus, "although it is indeterminate as to which particular egg was the first chicken egg, we can know that whichever egg that may be, it precedes the first chicken" (Sorensen 1992, 541).

Finally, a bit of political correctness has entered into the chicken-and-egg question. Waller (1998) points out, that male dominated biology has long been obstructing us from taking into account important facts of female biology and urges that the mother came before the egg. One of his main points is that "egg" is an ambiguous word, used both for the female reproductive cell and for "the larger spheroid object, [...] found in nests [...] and refrigerators" (Waller 1998, 851). Taking the word in this latter sense in what follows, the egg is not rightly considered to be an initial temporal part of the chicken. Rather, the zygote is the initial temporal part of the chicken, and that is only part of the egg.[1] As Waller rightly remarks, this view was already held by Aristotle in his *Historia Animalium* (I 5, 489b6–8).

Another suggestion has been put forward by Raatzsch (2001). According to him, the chicken-and-egg question is based on a confusion between spe-

1. The *egg cell* (or ovum) is still another thing. In unfertilized breakfast eggs only the yolk belongs to the egg cell, thus the egg cell is only a part of the unfertilized egg. Through fertilization by a sperm the egg cell can transform into a zygote. I owe this remark to Mathias Brochhausen.

cies and individuals. While individual chickens hatch from eggs that have been laid by other chickens, this does not tell us, according to Raatzsch, how the chickens as a natural kind came into being. Raatzsch conceives of both of these facts as empirical matters, while the task of the philosopher is to distinguish conceptually between the two kinds of questions (Raatzsch 2001, 570).

This is the state of the discussion so far. In the remainder I have a twofold goal: I want to show, first, that the dispute between Sorensen and Waller rests on an ambiguity of a term like "chicken egg". Secondly, I suggest some terminology to make the vagueness of biological species explicit. Finally, I try to approach the chicken-and-egg question by means of this terminological apparatus, and to point out which questions really are in need of empirical investigation.

3. Chicken-produced and Chicken-producing Eggs

In spite of all discussion, it remains true that chickens hatch from eggs. Eggs can be both chicken-produced eggs and chicken-producing eggs. With respect to sperm this distinction, too, has already been pointed out by Aristotle, in his treatise *De Partibus Animalium* (I 1, 641b 33-37). Once this distinction is accepted, we can formulate the following two statements as analytic truths, without any need for Waller's "empirical considerations" (1998, 852):

(C1) Chickens always hatch from chicken-producing eggs.
(C2) Chicken-produced eggs are always laid by chickens.

Now, the dispute between Waller (1998) and Sorensen (1992) comes down to the question: which eggs are we talking about? Given the producing/produced distinction, there is no contradiction involved in stating (T) and (W), since these are claims about different kinds of eggs:

(T) Sorensen's claim: The chicken came first, i.e. the chicken is temporally prior to the chicken-produced egg.
(W) Waller's claim: The egg came first, i.e. the chicken-producing egg is temporally prior to the chicken.

Both Sorensen and Waller base their analysis on Darwinian evolutionary theory plus vagueness of the sortal terms involved. Obviously, the vagueness

analysis is not required if we choose a naïve creational framework, stating that things just popped up or have been made by God *ex nihilo*. But if we choose the evolutionary framework, the vagueness analysis comes in handy. Now the sortal reference of "egg" is wider than just chicken eggs, as eggs can equally well be laid by "birds, reptiles, and monotremes", as Waller (1998, 851) remarks. Hence, a chicken-producing egg is not necessarily a chicken-produced egg, but may be laid by a mother of some other kind. This seems to support Sorensen's view.

Thus Sorensen's answer seems to fit more to an ordinary understanding of the chicken-and-egg question, while Waller is giving the right answer to the wrong question. That is, Waller is answering the question whether chicken-produced egg or egg-producing mother came first. But neither is there necessarily a sortal reference to chicken in "egg", nor a gender reference in "chicken".

4. Quasi-Species

But let us now make explicit the vagueness involved according to Teichmann's analysis. In what follows, I reserve the term "chicken" for the currently existing members of that species. I will now introduce the technical phrase "$(x \pm 1)$-%-chicken" (with $1 \leq x \leq 99$) to denote an organism which resembles a chicken to a degree of $(x \pm 1)$ %. Admittedly, even contemporary chickens vary from each other to some degree. Therefore, I will assume that contemporary chickens are (99 ± 1)-%-chickens. And I will use the term "quasi-chicken" to denote any organism that is a $(x \pm 1)$-%-chicken for some x (with $1 \leq x \leq 99$) and is evolutionarily connected with currently existing chickens (i.e. is an ancestor of some contemporary chicken).

In the preceding section I argued that, within the Darwinian framework, the following two priority claims are true out of conceptual reasons:

(P1) Chicken-producing eggs are prior to chickens.
(P2) Chickens are prior to chicken-produced eggs.

Given my technical terms, the following priority claims may also be uncontroversial:

(P3) $(x \pm 1)$-%-chickens are prior to $(x \pm 1)$-%-chicken-produced eggs.
(P4) $(x \pm 1)$-%-chicken-producing eggs are prior to $(x \pm 1)$-%-chickens.
(P5) Quasi-chickens are prior to quasi-chicken-produced eggs.

However, it does not appear true to me that quasi-chicken-producing eggs are prior to quasi-chickens for the following reason: It might well be that "egg" is a vague term, too. But back in the evolutionary process there are clear cases of non-eggs. For the very early ancestor of today's chickens, the (2 ± 1)-%-chicken, say, neither hatched from eggs nor laid eggs, but reproduced presumably by cell division.

For the sake of argument, I will now assume a rather chicken-centric view of natural history: I will assume that evolution came along with increasing chicken-similarity. This implies that if a $(z \pm 1)$-%-chicken is the offspring of an $(x \pm 1)$-%-hen and a $(y \pm 1)$-%-cockerel, then z must be larger than or equal to both x and y; i.e.: $z \geq \max(x, y)$. That comes down to the following claims:

(P6) $(x \pm 1)$-%-chicken-producing eggs are prior to $(y \pm 1)$-%-chicken-producing eggs, if $x < y$.
(P7) $(x \pm 1)$-%-chickens are prior to $(y \pm 1)$-%-chickens, if $x < y$.

By transitivity of temporal priority we get the following:

(P8) $(x \pm 1)$-%-chicken-producing eggs are prior to $(y \pm 1)$-%-chickens, if $x < y$ (from (P6) and (P4), or from (P4) and (P7)).
(P9) $(x \pm 1)$-%-chickens are prior to $(y \pm 1)$-%-chicken-produced eggs, if $x < y$ (from (P7) and (P3)).
(P10) $(x \pm 1)$-%-chicken-producing eggs are prior to $(y \pm 1)$-%-chicken-produced eggs, if $x < y$ (from (P8) and (P9)).

With the conceptual conventions I suggested, we get in addition:

(P11) Quasi-chicken-producing eggs are prior to chickens (from (P8)).
(P12) Quasi-chickens are prior to chicken-produced eggs (from (P9)).

And, again by transitivity:

(P13) Quasi-chicken-producing eggs are prior to chicken-produced eggs (from (P11) and (P2)).

Thus, which answer we want to give to the chicken-and-eggs question essentially depends on how much vagueness and which implicit sortal references we want to enter into concepts in both the question and the answer. And while (P1) to (P5) are, within the Darwinian framework, to be assumed to be true for conceptual reasons, the priority-claims (P6) to (P13) are no matter of conceptual analysis alone, because they presuppose chicken-centrism, which may be empirically false. Through this, certain aspects of the chicken-and-egg question are open both for empirical research and speculation.[2]

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2. This paper is dedicated to Mechthild and Niko Strobach, because maybe that other Greek philosopher was right, who claimed that friendship came first.