



LETTER TO THE EDITORS

Reply to «A matter of judgment: a response to Carneiro, Cunha and Curate (2017)»

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We are surprised to know that a small article, such as «Uma questão de método: a idade gestacional do feto do Paleolítico Superior de Ostuni (Itália)», has been the subject of a full-fledged «judgment» filed by Spake et al. (2018). Nevertheless, we believe that the authors missed the crucial point of the text – most probably because the text

was written in Portuguese, a language that, we suspect, only one third of the authors of «A matter of judgement...» understand in reasonably good terms. Our purposes were not to criticize «Nava et al.'s (2017) choice of methods for age estimation of an Upper Paleolithic fetal skeleton from Italy». The aim of the article was, and we translate it directly

from the Portuguese, «to estimate the gestational age (GA) of the Ostuni fetus through regression formulae based on the length of long bones, developed by Carneiro *et al.* (2016), and compare the results with those obtained by Nava *et al.* (2017) through virtual histology and by Vacca *et al.* (2012) through the length of long bones». An in-depth reading of our article should have made clear that our criticism was not about the virtual histology method (i.e., the «dental method») but focused instead on the chosen «long bones» methods, namely those by Fazekas and Kósa (1978), and Scheuer *et al.* (1980). The article states the long-known problems of these two methods, including their proclivity to overestimate GA in fetal remains (not «juveniles», as this is a term that in mammals designates individuals between birth and maturity).

The ulna was not included because it is a bone that is employed less often to estimate GA. Notwithstanding, the estimated GA with the ulna is 33.96 weeks, that is, circa five days older than the result given by the radius. Five days. How irrelevant is this when we know that even the clinical determination of gestational age based on maternal menstrual history and ultrasound data is not entirely accurate? Moreover, the ulna result is entirely congruent with the pattern observed with the other bones – closer to the GA given by virtual histology – and more than two weeks younger than the result obtained with the Scheuer *et al.* (1980) technique (36.4 weeks).

Spake *et al.* (2018) also state that «in discussing the accuracy and bias of their age estimation method, Carneiro *et al.* (2016)

acknowledge that inverse calibration of age estimation methods has the potential to provide biased age estimates (see also [Aykroyd *et al.*, 1997](#))». In Carneiro *et al.* (2016), we sustain relevant statistical postulates for this matter: that inverse calibration models show a better accuracy in the estimation of GA, a theoretically expected outcome due to the lesser mean quadratic errors in interpolations ([Besalú, 2013](#)), and a smaller bias with the classical calibration models (but not on the femur). However – and this is very important – when the coefficient of determination (R^2) is close to 1, which is the case for the linear models fitted in the original study (adjusted R^2 always equal or superior to 0.9), the discrepancy between the classical and inverse procedures is curtailed ([Besalú, 2013](#); [Lucy *et al.*, 2002](#)). In unassuming terms, the higher the correlation, the lesser is the bias.

Of course, we agree that results for age estimation should be given as confidence intervals. Nonetheless, as the supplementary material by Nava *et al.* (2017) and Vacca *et al.* (2012) emphasized point estimates for GA, we followed that precedent. What is important is that again our results are closer to the virtual histology method than those from Fazekas and Kósa (1978), and Scheuer *et al.* (1980) – especially if we analyze it bone by bone and do not lump all the results in one single confidence interval. Once more, we never state that our method is better than any dental methods, we just declare that it performs better than the ones by Fazekas and Kósa (1978), and Scheuer *et al.* (1980).

The next section is just an innocuous tirade about the methodological weaknesses of Carneiro et al.'s (2016) technique, essentially following what is thoroughly discussed in the PhD Thesis by Carneiro (2015) and elsewhere (Adalian et al., 2001; Piercecchi-Marti et al., 2003). This part of the text by Spake et al. (2018) is somewhat confusing because we really never know to what article, poster or thesis they are referring to. One thing is certain: it is not the paper being «judged». Anyway, the paucity of identified skeletal collections that include fetuses with known GA requires that we follow unconventional resources, including radiographic approaches, in order to investigate fetal anatomical variation. It is revealing that no sampling alternatives are suggested by Spake et al. (2018).

Spake et al. (2018) try to put on intentions in our article that are simply not there. We appreciate the summary concerning the differences between skeletal and dental age, but it is foreign to the purposes of the article and can be read in any standard textbook of forensic anthropology or bioarcheology. We will claim it again: our problem was with the chosen skeletal age methods not with the dental methods. Also, this is not true: «Their comparison of dental and skeletal growth is also misleading and fails to recognize them as complimentary (sic), not equivalent, estimators of age». We clearly state that we must consider all available procedures and evaluate them according to their advantages or weaknesses. It is clear that, as a rule, dental methods perform better, with higher accuracy and lower bias (see Carneiro et al., 2016); notwithstanding, in the case of fetal

remains the «weakness» of the dental methods is related with «availability»: crown mineralization only occurs between the 3rd and 4th months in utero and due to their extreme small size they are more likely to not be recovered. In many instances, skeletal age is the only available method (Sunderland et al., 1987).

This «judgment» could entail a fitting discussion about different statistical approaches on age at death assessment in fetal remains but is overly reliant on equivocal phraseology and vague suspicion. One example is the iterated use of the expression «one wonders». Science is about facts and their discussion, not unclear personal beliefs. One wonders how this display of speculative misgivings and self-indulgent ill-intentions is tolerable in a scientific journal.

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