Correspondence

When is a hypothesis null?

DEAR SIR,

At a recent meeting of the Midland Branch, the topic of the *null hypothesis* arose in discussion. It was clear on that occasion that the concept causes trouble in teaching statistics in schools, and examiners' reports confirm this from time to time.

Since the meeting I have looked at a number of books on statistics and it appears to me that one of the causes of confusion amongst teachers is the vagueness of textbooks (my own included) and, indeed, differences in the interpretation of the term. Has, I wonder, the usage of the phrase changed since its introduction by Fisher? For instance, Siegel writes in *Nonparametric statistics:* "The *null hypothesis* is a hypothesis of no differences. It is usually formulated for the express purpose of being rejected." This would appear to exclude, for instance, a hypothesis about the ratio of (i) two heads, (ii) a head and a tail, (iii) two tails, on spinning two coins a number of times.

My own experience suggests that it is partly the unfamiliarity of the concept that causes trouble, but also the word *null*—which does not convey to the modern person the essence of what is meant. If I may suggest another word (for the classroom, rather than the examination question), it would be *skittle*: a skittle hypothesis is specially set up in order to be knocked down. But, seriously, would any statistician be prepared to say what is the modern interpretation of the phrase null *hypothesis*—in words, please, that the average sixth-former can understand?

Yours faithfully,

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Discontinuity

DEAR SIR,

The article on *The Transition from School to University Mathematics* in the October 1972 *Gazette* concluded "The present evidence suggests that in many instances the sixth-form teacher has not made himself aware of the work required for a first-year honours course, nor has the university lecturer familiarised himself with school conditions". What conditions? Small classes and the asking of questions in class? Or the approach used in school mathematics? What is "work required for first-year honours courses" that the teacher should make himself aware of? Analysis? The subject matter of school calculus? What is the fundamental difference between the subject matter of these two courses? Why do the majority of sixth-formers think of calculus as the "topic most enjoyed" and the majority of first-year undergraduates report analysis the "most difficult subject"? What is the first-year analysis course other than the subject-matter of sixth-form calculus and convergence taken from the point of view of a mathematician? Why should differentiation, integration and functions defined by series be topics that are powerful and appealing to sixth-formers, and the same topics a year later be difficult, baffling and often nauseating to mathematics undergraduates?

We all know the answer to this question—it is the Onset of Rigour (or *rigor*?). This search for rigour is a necessary part of the process of turning the 'look for a pattern' child of 11 into the sophisticated mathematician of 21. At 18, we drop him, having blessed him with good grades in A level double-subject mathematics, from the frying-pan of never having seen why he should not differentiate $\sin^{-1}(1 + x^2)$ or any other expression he can write down, into the fire of proving that if $f(a) < 0$ and $f(b) > 0$, then $f(x) = 0$ at some point x between a and b, provided that f satisfies an obvious condition that every reasonable function which he has ever heard of satisfies anyway. Is it any wonder that he regards

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