The Decline of the Traditional Church Choir: The End of an Era?

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Introduction

In the first of these two articles, such data as is available on the number of boy choristers in Anglican parish-church choirs was presented and analyzed. A mathematical model was developed that enabled an estimate to be made of the number of men who, as a result of the fall in the number of choristers and the secularization of State education, would have been largely untouched by Christianity. The estimate for this year is a little over a million; by 2029, the end of the choirboy era - when a nine-year old in 1963 would be 75 years old - the estimate is about two million. The mathematical model is 'phenomenological' in that it is essentially an attempt to describe the change in the traditional choir rather than to explain what has happened or to establish possible causes.

The model was based on two ideas. The first is that the rate of fall in the number of choirboys would have to be proportional to their number. Otherwise, there would come a time when all the remaining choirboys in the UK would disappear almost simultaneously. A far more likely scenario is that, as with many other naturally-occurring decay processes, the *fraction* lost in any given time period remains more or less constant throughout. The second basic idea was that there had been a time of relative stability before the decay process became noticeable, a time during which whatever was causing the decay had had hardly any effect but nevertheless had come into existence. These two ideas are sufficient for a mathematical description of the process, the logistic model, which fits the available data.

However, little has actually been gained by simply fitting a mathematically-generated curve to some points on a graph. What is required is a *theory* that provides some kind of explanation for the observed decline of the traditional church choir. Without such a theory it will be impossible to identify in a convincing manner the cause(s) of the decline or to gain the support required to put matters right.

Two hypotheses

It is generally accepted by scientists that a scientific theory cannot be proved; the best we can hope for is that it will fail to be falsified by experiment on very many occasions and for a wide range of experimental conditions [8]. In the present context, however, it would be impossible to treat every parish-church choir as a separate experiment and to compare changes in its size and composition with theoretical expectation. On the other hand, a theory expressed in terms of the total numbers of choristers, both male and female, and of all ages, is the choral equivalent of those branches of science that deal with the properties of large numbers of individual entities whether they be sub-atomic particles, atoms or molecules.

If a theory is to be tested by comparing measurements with calculated results, it is clearly necessary to 'formulate' the theory in terms of a mathematical relation between the various physical factors of interest, e.g. mass, length, time, temperature, etc. But before we can formulate the theory, we must have some fundamental ideas, however vague or fanciful, upon which to base our equations. In the history of science, there have been many such basic ideas which have been rejected because the theories based on them failed the acid test of experiment, e.g. phlogiston (a hypothetical substance released on burning). Even Newtonian mechanics, once regarded as the corner stone of physics, fails in this regard.

So what are the fundamental ideas - the *hypotheses* - on which we are to base our theory of the decline of the traditional choir? According to Dr Martin Ashley [9] of the University of the West of England, evidence supports "the claim that if girls were allowed in the choir, most boys would leave". Our first hypothesis is then that the rate of decline in the number of boys in parish-church choirs is not only proportional to their total number (n) at any given time (t) but *is also proportional to the total number of girls* (g). The first part of this hypothesis is the same as that used previously (the 'radioactive decay' model), and which led to the logistic equation; the second part embodies the idea that boys are reluctant to remain in choirs with girls or perhaps even to be associated in the minds of their peers with an activity favoured by girls.

The second hypothesis is that the rate of *increase* in the total number of girls in parish-church choirs is not only proportional to their total number at any time but *is also proportional to the total number of boys*. In this case, the first part of the hypothesis is typical of many naturally occurring growth processes. Such 'exponential' growth processes are characterized by a doubling in a fixed period of time, e.g. the population of the world doubles in roughly a century. The second part of the hypothesis is an expression of the innate feelings expected of any group excluded, in what is perceived to be an arbitrary fashion, from any given activity regarded by that group as desirable. It is equivalent to saying that girls are attracted into choirs because of a 'me too' factor (if the boys can do it, why can't we?).

As shown in the Appendix, these two hypotheses can easily be expressed in the form of two 'rate' equations each of which contains both dependent variables, n and g, and which in general are assumed to have *different* rate constants. In other words, no other assumption has been made about the relative rates at which boys depart from choirs and girls join. It is also shown in the Appendix that these two equations can be rearranged to give two more equations each of which involves either n or g, but not both. Moreover, apart from a sign, the second pair of equations are of the same form and have *numerically identical rate constants*. In other words, once the two dependent variables have been separated, it is a logical consequence of the two hypotheses that the rate of increase in the number of girl choristers exactly matches the rate of decline in the number of boys; the two processes are mirror images of each other. We have therefore demonstrated on the basis of the two hypotheses that during the time when there are significant numbers of boy *and* girl choristers, the state is essentially <u>unstable</u>.

In addition to this somewhat surprising result, it is also shown in the Appendix that the equation derived in this way for the number of boys is of *exactly the same logistic form* as that assumed in the first article, a form that was adopted largely as a matter of fitting an equation to the available data. The assumption of a logistic curve for boys is therefore supported *a posteriori* by the logical consequences of the two hypotheses.

Whereas the logistic curve for boys starts from a notional steady state n_0 sometime prior to 1963 (calculated to have been about 182,000 boys), the logistic curve for girls rises from a very small number shortly after WW2 to a steady but unknown level g_0 sometime after about 1980. Unfortunately, it is not possible to deduce the steady number of girls from the available data; all that can be done is to locate the curve on the year axis using the published figure of 80,000 girls in parish-church choirs in 1963 [10]. However, because the transition, from the state in which choirs were largely all-male to one in which the majority of the top-line were female, occurred over a relatively short period of time (less than about thirty years), it is likely that the steady-state number of girls will be roughly equal to that for boys. By a ‘relatively short period of time’, we mean comparable with the average time a man is expected to be a member of a parish-church choir, often thirty or forty years. The conclusion must be that the typical choir will have survived the transition, that its *size* will have been fairly stable during the transition years and that only its *composition* will have changed. We therefore make the further assumption that the notional steady-state number of girls will be equal to that of the boys. From this assumption, and the published value of g for 1963, we can then easily add the logistic curve for girl choristers to that already shown in figure 1 of the first article; it is also a simple matter to add the curve for the total number of choristers, as shown in figure 3.

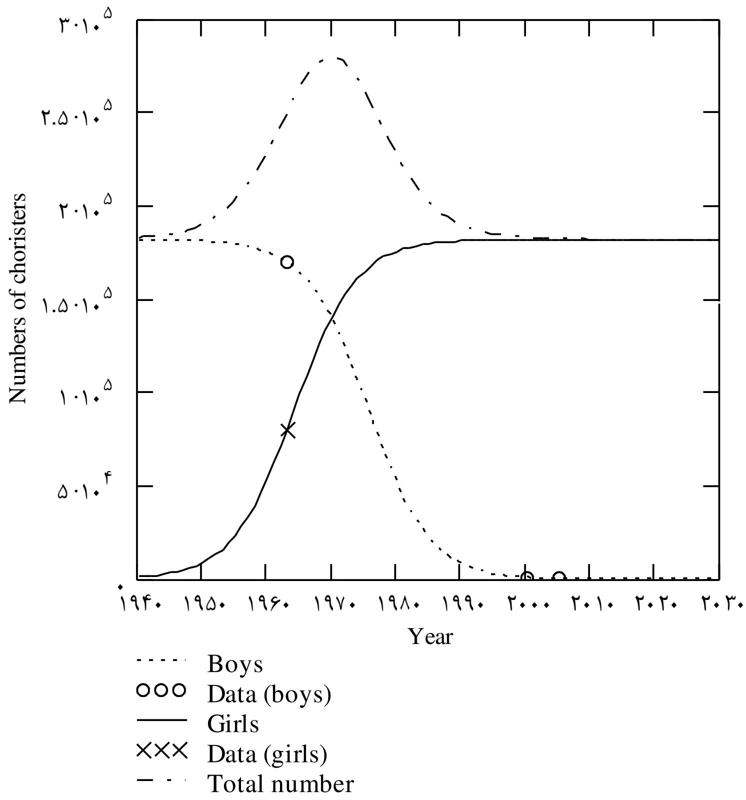

Figure 3. Numbers of boy and girl choristers and the total number of young choristers plotted against the year; according to the analysis, the two logistic curves must have the same rate constant although it is assumed that the steady-state values for each curve are equal. The analysis indicates that the total number of choristers reached a maximum of 280,000 in 1970.

A point of clarification must be made at this point. The rate of increase in the number of girls, which forms the basis of the analysis, represents the *nett* rate of increase; the steady state is one in which the number of girls leaving exactly matches the number arriving. There is no implied change in either the mean age or the age distribution of the girls. If we assume that girls arrive and depart at about the same ages as for the boys, the analysis so far can be readily extended to considerations of the age distributions of *men and women* in church choirs, we shall return to this topic later.

Before outlining the results thus obtained, however, there is a further observation that must be made; one of the plots shown in figure 3 indicates that at about 1970 the total number of young choristers reached a maximum of about 280,000, and thereafter began to fall to the steady-state number of about 182,000 of whom the vast majority would have been girls. The graphs indicate that in 1970, not only would there have been perhaps the largest number of young choristers in the history of church music in the UK, but there would have *been equal numbers of boys and girls*. At this time, a strong case could have been made in favour of admitting girls into parish-church choirs. The proponents of the case for the girl chorister would have been able to claim the apparent success in 1970 as evidence that the admission of girls had been generally beneficial. Although many traditionalists had misgivings about admitting girls, no convincing counter-claim could have been made at the time because the trends underlying the apparent success were difficult to detect, let alone quantify. Few would have realized in 1970 that the trends were potentially disastrous and indicated a fundamental instability in the overall composition of the young chorister population.

The relative numbers of men and women in church choirs

In the first of these articles, a mathematical model was used to estimate the number of men who would have been boy choristers had the notional steady state persisted indefinitely rather than giving way to the logistic decline. Having now established the fuller picture of the related changes in the numbers of boy and girl choristers, we can now estimate some of the properties of the total *adult* populations of Anglican parish-church choirs. To make such estimates, it is necessary to make one or two additional assumptions. The estimates are therefore only as plausible as the assumptions upon which they are based, and must be treated as such. Nonetheless, if the assumptions are reasonable and accord with common sense, the estimates should be a fairly accurate reflection of the real situation.

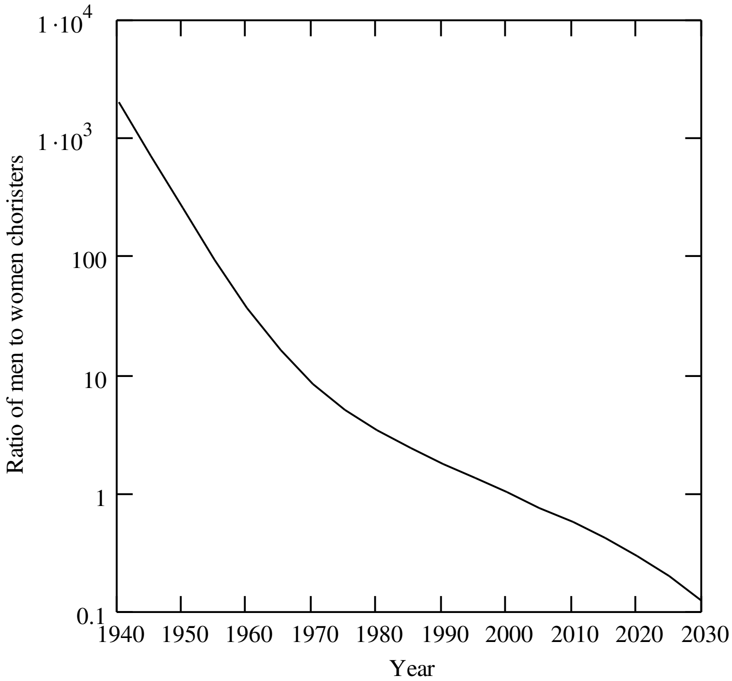

Figure 4. The ratio of men to women choristers in Anglican parish-church choirs plotted against year; it is estimated that there were roughly equal numbers in the year 2000 but by the year 2030, the women could possibly outnumber the men by nearly 10:1.

As shown in the Appendix, it is possible to estimate the way in which the ratio of men to women choristers varies with time. We assume that men choristers are primarily drawn from the ranks of the boys who have outgrown the top line, notionally at the age of fifteen. For the sake of convenience, we define women choristers as those female members of choirs who have also reached the age of fifteen. We also assume that equal, but unknown fractions of each sex remain after the age of fifteen and that, roughly speaking, these adult choristers remain indefinitely or are replaced by those of similar age. In other words, we assume that the numbers of men and women moving into the adult category at any given time are proportional to the numbers of the oldest boy and girl choristers at that time, and that the constants of proportionality in the two cases (α) are equal. In calculating the resulting ratio of men to women choristers, we then find that the *unknown* constant of proportionality cancels out and the numerical value of the ratio can be calculated in absolute terms and plotted as a function of time, as shown in figure 4.

The age distributions of men and women in church choirs

Although it is possible to deduce *algebraic* expressions for the numbers of adult choristers for any given year in terms of the unknown constant α, it is not possible to obtain *numerical* values without a numerical value for this constant. However, there are meaningful statistical parameters that can be obtained from the analysis without prior knowledge of the unknown constant. Two such parameters are the mean age (μ_1) and the age range for the adults of each sex, the latter expressed through the standard deviation (σ) of the age distribution, as shown in the Appendix. The variation in these four parameters with time is shown in figure 5.

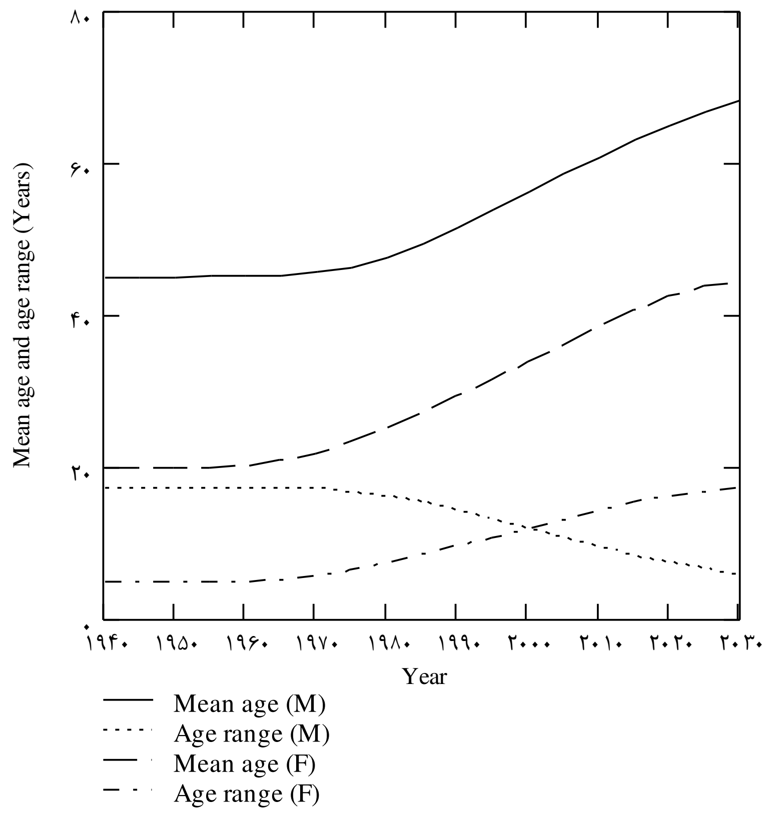

Figure 5. The mean age and age range for men and women choristers in Anglican parish-church choirs plotted against year; the mean age of the men consistently exceeds that of the women by nearly two decades whereas the age range for men is now falling and that for women is increasing.

As described in the Appendix, we can visualize the age distribution of either sex by saying that, roughly speaking, the upper and lower ends of the age range are given by the mean plus or minus the standard deviation; in symbols, the range is then from $\mu - \sigma$ to $\mu + \sigma$. Although the plots in figure 5 quite clearly show the trends in the mean ages and age ranges for the two sexes, in particular that their age ranges were roughly equal in the year 2000, what is perhaps not so evident are the following results which are probably a consequence of the symmetry of the two logistic functions.

First, the mean age of men at the earliest times shown in the graph is almost exactly the same as that for women in the year 2030 (~45). Second, the standard deviations for the two groups in the year 2000 are also about the same (12 years). Third, the initial standard deviation for men and the final value for women are also about the same (17 years). Finally, the standard deviations for men in the early years and for women in the year 2030 are also about the same. These results are summarized in the table, in which the ‘minimum’ and ‘maximum’ ages are expressed in terms of $\mu - \sigma$ and $\mu + \sigma$, although it should be borne in mind that these figures are notional in the sense that the true age distributions will be quasi-continuous functions with ‘tails’ and also are likely to be asymmetrical about the means. Moreover, the accuracy of the calculated results depends on the assumptions outlined earlier and are therefore only an indication of the actual situation.

	Ages of men		Ages of women	
Year	Min.	Max.	Min.	Max.
Pre-1960	27.7	62.3	15.0	24.6
2000	44.3	68.0	22.0	45.8
2030	62.6	73.8	27.3	61.6

Table 1. The notional maximum and minimum ages of adult choristers in Anglican parish-church choirs for the period prior to the transition, for the year 2000, when the age ranges of men and women are reckoned to have been equal, and at the end of the choir-boy era.

Summary and Conclusion

A fair criticism of both the present and previous articles is that the theory of the decline of the traditional choir is based on insufficient data. However, this criticism relates merely to *numerical* data and not to the very substantial amount of historical information which, though unquantified and perhaps even apocryphal, is nonetheless of value. For those who have spent a lifetime in parish-church choirs, there is no doubt that there has been a major change in the composition of such choirs, and that the time-scale during which the change has occurred is relatively short. It has been demonstrated that a theory based on two simple hypotheses leads to such an instability, both in terms of scale and duration. Moreover, it is shown that not only can this transition be expressed numerically, but that the future composition of adult choirs can also be quantified. Although there has been much discussion amongst scientists of the relative merits of testing a theory either against experiment or in terms of its predictive power [11], the predictions presented above will remain valid only so long as the underlying assumptions are valid. If bodies such as the *Royal School of Church Music* have data that invalidate the theory, then the predictions based on it could have been safely ignored were it not for the fact that the boy chorister is already almost extinct in parish churches.

That the same phenomenon is absent from cathedrals is still used to perpetuate the myth that the admission of girls into parish-church choirs can be achieved without the loss of the boys. Perhaps the main reason for the stability of the cathedral choir is that the presence of the boys is hardly voluntary, at least in the sense that applies in the parish context. The essential instability associated with the admission of girls into parish-church choirs is because the boys are free to leave.

If we regard the idea of ‘inclusiveness’ as part of some kind of ‘social theory’, then such a theory should be tested in exactly the same way as that propounded in this article, that is by a comparison between experience and prediction - perhaps regarded as a logical consequence of the theory rather than ‘something known beforehand’. The proponents of the idea of ‘inclusiveness’ were presumably predicting the full and equal participation of both sexes in parish-church choirs, it being inconceivable that they were actually *intending* to drive out the boys. That being the case, the fact that there are now hardly any parish choirboys must surely point to the failure of this theory. By the same token, albeit in the light of hindsight, the theory presented above accords exactly with the fact that the era of the traditional parish-church choir is now all but over.

So the difference between these two theories is clear; the idea of inclusiveness is shown to be flawed in that it clearly leads to undesirable consequences. Apart from the loss of the tradition, over a million men will have been denied the experience of choir membership or, in view of the increasing secularization of the State education system, with any experience of Christianity. The leaders of the Church of England, now strongly criticized for their silence on a number of important social issues [12], appear to support the adoption of exactly the policies that have not only contributed to the near destruction of the choral tradition but have thereby contributed to the social evils associated with its loss and which epitomize the widespread moral decay we now see all about us.

References

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Appendix

The two hypotheses on which the theory is based can be readily formulated in mathematical terms. If the total number of boys at any time t is denoted by n, the rate of *decline* of this number, which is proportional not only to n itself but also to the total number of girl choristers g in Anglican parish-church choirs, can be written as

$$dn/dt = -\mu ng \qquad (7)$$

in which μ is the constant of proportionality. Similarly, the rate of *increase* in the number of girls can be written as

$$dg/dt = +\varphi gn \qquad (8)$$

in which the constant of proportionality, φ, is in general *different* from μ. We can easily rearrange these two equations to obtain

$$gn = (1/\varphi).(dg/dt) = -(1/\mu).(dn/dt) \qquad (9)$$

A simple analytical operation (integration) carried out on this latter equation then leads to the result that

$$g/\varphi = -n/\mu + c \qquad (10)$$

The value of the constant (of integration) c is determined by noting that at a time when there was a negligible number of girls, i.e. when g = 0, the number of boys was the steady-state number n_0; it then follows that the constant c must equal n_0/μ. Eq.10 then becomes

$$g/\varphi = -n/\mu + n_0/\mu = (n_0 - n)/\mu \qquad (11)$$

so that

$$g = \varphi.(n_0 - n)/\mu \qquad (12)$$

When this expression for g is substituted into eq.7, we obtain

$$dn/dt = -\mu n\varphi.(n_0 - n)/\mu = -n\varphi.n_0(1 - n/n_0) = -\kappa n(1 - n/n_0) \quad (13)$$

on cancelling the constant μ, rearranging the result and setting φn_0 equal to the constant κ, i.e.

$$\varphi n_0 = \kappa$$
(14)

Eq.13 is *exactly the same differential equation that was introduced in the previous article*; in the present case, however, this equation was *deduced from the two hypotheses* rather than as a means of fitting a curve to some data points. The solution to eq.13, the logistic function, is therefore given by eq.2 of the previous article.

By an analogous argument, when the number of boys has become negligible, eq.8 tells us that the rate of change in the number of girls, dg/dt, is also negligible and that therefore the number of girls is another constant number, g_0. It then follows that the constant c in eq.10 must equal g_0/φ. Eq.10 then becomes

$$n/\mu = -g/\varphi + g_0/\varphi = (g_0 - g)/\varphi \quad (15)$$

so that

$$n = \mu.(g_0 - g)/\varphi \quad (16)$$

When this expression for n is substituted in eq.8, we obtain

$$dg/dt = \varphi g\mu.(g_0 - g)/\varphi = g\mu.g_0(1 - g/g_0) = \lambda g(1 - g/g_0) \quad (17)$$

on cancelling the constant φ, rearranging the result and replacing μg_0 by the constant λ. The solution to this last equation is again of the logistic form; it is of the same form as eq.13 apart from the leading sign which denotes an increasing, rather than a decreasing function of time.

In deducing eqs.13 and 17, we have derived two expressions for the constant of integration c, i.e.,

$$c = n_0/\mu = g_0/\varphi \quad (18)$$

from which it follows that φn_0 must equal μg_0. But as these terms are respectively equal to κ and λ, it follows that the two rate constants, κ and λ, *are also equal*. If, as discussed in the text, the steady-state values n_0 and g_0 can be *assumed* to be equal, the logistic curves for the fall in the number of boys and the rise in the number of girls will have equal and opposite slopes for any given fraction of the steady-state value; they will be mirror images of each other, as shown in figure 3.

The solutions to eqs. 13 and 17, respectively, are eq.2 of the first article and its analogue for the number of girls,

$$g(t) = g_0. [\{(g_0/g_1) - 1\}.\exp\{\kappa(t_1 - t)\} + 1]^{-1} \quad (2a)$$

in which, as proved earlier, the rate constant κ is the same in both solutions. The location of the curve of g *vs* t in figure 3 is fixed by the reported number of girls, 80,000, in 1963 [2].

If we assume that a fraction (α) of either boys or girls who reach the age of fifteen remain members of parish-church choirs, then we can estimate a number of characteristics of the *adult choirs* in the Anglican Church. First, we note that in the year t, the number of boys reaching the age of fifteen will be given by the expression $n(t)/\tau$, in which τ is the 'lifetime' of a boy chorister. Of these, the fraction α will remain. It then follows that s years later, in the year y = (t + s), when these boys have reached the age of a = (15 + s), the number of choirmen *of this particular age* is given by the expression $\alpha n(t)/\tau$. So in the year y, the *total* number of choirmen, N(y), of all ages between fifteen and seventy-five will be given by the sum of $\alpha n(t)/\tau$ for those ages, in symbols,

$$N(y) = \mathrm{Sum}[\alpha n(t)/\tau]. \quad (19)$$

However, from the above definitions, t = y – s = y – (a – 15) = (y + 15 – a) and therefore

$$N(y) = \mathrm{Sum}[\alpha n(y + 15 - a)/\tau] \text{ from } a = 15 \text{ to } 75 \quad (20)$$

In other words, the first term in the summation is given by $\alpha n(y + 15 - 15)/\tau$ *for a boy of fifteen in the year y*, i.e., $\alpha n(y)/\tau$, and the last term is $\alpha n(y + 15 - 75)/\tau$, or $\alpha n(y - 60)/\tau$, indicating that the 'boy' in question *in the year y* would have been fifteen, sixty years previously.

Although no figure is available for the parameter α, it is reasonable to assume that much the same numerical value would apply to girls; to obtain estimates for the factors of interest we can certainly make this assumption. In calculating the ratio, R(y), of *total number of men to that of women* in Anglican parish-church choirs, the unknown parameter α will cancel, as will the factor τ if we treat the two sexes equally. We then find that

$$R(y) = \mathrm{Sum}[n(y + 15 - a)]/\mathrm{Sum}[g(y + 15 - a)] \quad (21)$$

in which each summation covers the ages from fifteen to seventy-five. Although analytical expressions can be obtained for these summations (integrations), it was found to be convenient to use a purely numerical technique [7]. The results are shown in figure 4.

Two other factors of interest, that are independent of the unknown parameter α, are the mean age and the spread in ages for each of the two sexes in adult choirs. In each case, the appropriate equations are, for the mean ages

$$\mu_1 = \mathrm{Sum}[a \times n(y + 15 - a)]/\mathrm{Sum}[n(y + 15 - a)] \quad (22)$$

and

$$\mu_1' = \mathrm{Sum}[a \times g(y + 15 - a)]/\mathrm{Sum}[g(y + 15 - a)] \quad (23)$$

for the two sexes, respectively, the summations being over the same age range as before. An estimate of the spread in ages is given by a well-known expression [13] for the *standard deviation* of the age distribution. The method involves first calculating the *mean-square age,* of each distribution,

$$\mu_2 = \mathrm{Sum}[a^2 \times n(y + 15 - a)]/\mathrm{Sum}[n(y + 15 - a)] \quad (24)$$

and

$$\mu_2' = \text{Sum}[a^2 \times g(y + 15 - a)]/\text{Sum}[g(y + 15 - a)] \quad (25)$$

respectively, and then using the expression $\sqrt{(\mu_2 - \mu_1^2)}$ for the standard deviation. The results are shown in figure 5 and in table 1.

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