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Attitudes to Evolution amongst Christians, Muslims and the Non-Religious in Britain: Differential Effects of Religious and Educational Factors

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Abstract

According to poll results and media reports, Britain has a significant and growing number of creationists. However, little scholarly research has been carried out to explore this phenomenon. We present results from a national survey of 6020 individuals to give a comprehensive picture of contemporary public attitudes to evolution in Britain. Furthermore, we explore the effects of religion and education on attitudes to evolution. Unique to this study, we analyse the effects of attending a religiously-affiliated school ("faith school") on acceptance of evolutionary theory. We examine these effects in the general population, and additionally, across different Christian, Muslim and non-religious subpopulations. Results give strong evidence that the number of creationists has been overstated previously. We find the effect of education is complex and varies between different religious groups, but that faith school attendance is associated with more acceptance of evolution for people belonging to groups that tend to reject it.

Introduction

Headlines such as "*Academics fight rise of creationism"*, "*Why is creationism on the rise, and does it have a place in education?"* and *"Children 'indoctrinated' by lessons in creationism'*(Campbell, 2006; Bland, 2008; Paton, 2014) point to recurring concerns over rejection of evolution in Britain, which is somewhat surprising given that the country has experienced significant declines in both religious belief and practice over the past few decades (Brown, 2009; Voas and Crockett, 2005). Creationism is usually understood to mean religiously-motivated rejection of evolutionary theory, and, until recently, this was considered to be almost exclusively a feature of North American fundamentalist Christianity. However, it is believed that creationism has now "spread from America throughout the world" and found a home within diverse religious traditions (Numbers, 2006). There is a substantial literature on creationism in the US (for a recent review, see Pobiner (2016)) but little scholarly research on public attitudes to evolution in other national contexts, a point which has been highlighted by Blancke et al in a review article on creationism in Europe (Blancke, 2013).

We begin to fill that gap here by presenting results from a detailed study of evolution acceptance and rejection in Britain. Previous polls surveying public acceptance of

evolutionary theory in both the US and the UK have received criticism for providing inadequate measures of evolution acceptance, and we seek to address those methodological issues.

Given that there are no longitudinal datasets surveying attitudes to evolution in Britain, we instead designed our study to take into account recent religious changes in the country, and accordingly analyse six different religious groups: the two historically largest religious traditions (Anglican and Catholic Christianity) and four groups currently showing growth (Non-Religion, Islam, independent/non-denominational Evangelical Christianity and Pentecostal Christianity).

We create a multipoint scale of evolution acceptance to investigate which factors best predict evolution acceptance or rejection, and examine how educational and religious social factors may differentially influence acceptance of evolution in Britain. Furthermore, we investigate whether these effects differ significantly across the different religious groups surveyed.

Results from this study add to the growing body of evidence demonstrating that the simple provision of more education about evolution to address the public's "deficit" of knowledge may not be successful. Instead, the specific educational setting seems to be significant, a finding that should be of interest to education professionals and policymakers, particularly those in urban areas with large religiously active populations.

Public opinion polls about evolution in the US and the UK

Most of the literature concerning public attitudes to evolution is based on studies carried out in the United States. The widely-cited Gallup poll has been conducted periodically since 1982 and offers three response categories regarding attitudes to creation and evolution: 1) young earth creationism (God created human beings pretty much in their present form at one time within the last 10,000 years or so), 2) God-guided evolution (human beings have developed over millions of years from less advanced forms of life, but God guided this process) or 3) Evolution without God (Human beings have developed over millions of years from less advanced forms of life, but God had no part in this process). The percentage of the US population who choose the 'young earth creationism' option has remained fairly stable over the years, at between 42 and 47% (Newport, 2014).

Unlike the Gallup poll in the US, there are unfortunately no longitudinal studies in the UK surveying public acceptance of evolution, so it is not possible to say whether attitudes to evolution have changed over time. A number of polls conducted in the last decade give us

snapshots of the British public's attitudes to evolution (IpsosMORI, 2006; Lawes, 2009; Eurobarometer, 2005; Elsdon-Baker, 2015), but no studies have been conducted to explore which factors best predict acceptance or rejection of evolution within the general population.

Depending on the way the question is asked, and how the different response categories are defined, the percentage of people reported to accept evolution in Britain varies considerably, ranging between 38% (Elsdon-Baker, 2015) and 79% (Eurobarometer, 2005), whilst the percentage of "creationists" ranges between 9% (YouGov, 2013) and 22% (BBCNews, 2006; IpsosMORI, 2006). The most detailed poll on evolution in Britain to date was commissioned by the thinktank Theos and reported that opinion was often "confused and contradictory" (Lawes, 2009).

Most of the polls offer a limited number of pre-determined response categories, which tend to package together beliefs about God, evolution, and the age of the earth in combinations that may not accurately represent many people's knowledge and/or beliefs. For example, the Gallup poll question classifies all people who reject evolution as young earth creationists and all non-theists as adhering to the consensus position of scientists, old earth evolution.

This type of problem was highlighted in a review of social scientific literature, which found that an assumption of epistemological conflict between religion and science is present in many studies (Evans and Evans, 2008). Bader and Finke found that responses to questions about human origins vary considerably, depending on factors such as the ordering of questions, how the answer categories are phrased, and whether the answer categories offered are mutually exclusive and exhaustive (Bader and Finke, 2014). The framing of poll questions about evolution has also been extensively critiqued by Elsdon-Baker who points out that polls often present "an overly simplistic binary choice – either you accept evolutionary science *or* a creator God" (Elsdon-Baker, 2015). A recent US study tackled this methodological issue by disaggregating the components of common survey questions about human origins (Hill, 2014).

Results from these types of polls have led some to conclude that there are large numbers of people who subscribe to young earth creationism, for example Richard Dawkins writes: "More than 40% of Americans deny that humans evolved from other animals, and think that we – and by implication all of life – were created by God within the last 10,000 years. The figure is not quite so high in Britain, but it is still worryingly large." (Dawkins 2010: 430)

Predictors of evolution rejection

Studies in the US consistently show that four main factors are related to acceptance of evolution: religiosity, education, age and political party affiliation (Pobiner, 2016; Miller et al., 2006; Haider-Markel and Joslyn, 2008; Baker, 2012; Baker, 2013; Rivers, 2006). Frequent church attendance, increased age and Republican party affiliation are all positively correlated with young earth creationism; whereas higher levels of education are positively correlated with theistic or secular evolutionary views (Pobiner, 2016). Far less is known about the factors related to evolution acceptance or rejection in other national contexts, including Britain. This raises the question of whether factors predictive of evolution rejection in the US are generalizable beyond that particular context.

Most studies treat religion and education as separate variables, which largely makes sense in the United States, given that it is a country with a large religiously active population but a constitution that enshrines separation of religion and state. This means that American public schools – in which over 90% of the population receive their schooling – cannot be religiously affiliated. In contrast, Britain, like many European countries, has a national church and religiously-affiliated state-funded schools – but a much smaller religiously-active population. It has been said that religion in Europe "does not function as a separate channel of culture but as a distinctive current which mingles in the mainstream" (Berger et al., 2008). This leads us to ask not only the effect of religious service attendance and of education on evolution acceptance in Britain; but to also ask: is there an effect on evolution acceptance when a religiously-affiliated school is the context for education about science?

The British school system and the teaching of evolution

A major contribution of this study is therefore to investigate whether type of secondary school attended, that is, either a religiously-affiliated "faith school" or a secular school, is predictive of evolution acceptance or rejection. Bearing in mind that the impact of a variable such as education depends on the specificities of the local context (Blancke, 2013), we provide here some relevant information about the secondary schooling system in Britain.

Over 90% of school pupils in the UK are educated in state-funded schools, some of which have a religious affiliation (commonly referred to as "faith schools"), and some which do not. As of September 2015, 37% of all state-funded primaries were faith schools (mainly Church of England) and 19% of all state-funded mainstream secondaries were faith schools (mainly Catholic) (Long and Bolton, 2015). Since 1998, a handful of Muslim, Sikh and Hindu state-funded schools have opened (Long and Bolton, 2015).

Until recently, all state-funded schools in England and Wales were required to follow a National Curriculum, first introduced in 1989, which clearly states that evolution must be taught in science lessons, although it did not explicitly ban the teaching of creationism. But newer 'Academy' schools, which are state-funded but privately sponsored and governed by independent organisations such as charities, businesses and faith groups, are not required to follow the National Curriculum, although they do offer nationally recognized qualifications and therefore teach to the exam board syllabuses. Concern has been raised that creationism has been, or could be taught in faith-based Academy schools, the details of which are described elsewhere (Allgaier, 2014; Williams, 2008).

Most faith schools that are not Anglican or Catholic church schools are private independent schools that are not funded by the state and are not required to follow the National Curriculum. However, the majority of these offer nationally-recognised qualifications and therefore, like academy schools, teach to the exam board syllabuses.

Religious traditions and religious change in Britain

Research from the United States shows that individuals from some religious traditions are much less likely to accept evolution than others. Such detailed data has not previously been available for Britain because fewer studies have been carried out and because, due to a smaller population and much lower levels of religiosity, accurate statistics are not available for many religious groups.

The religious landscape in Britain has seen significant shifts over the past few decades, and these changes are linked to some of the concerns about a rise in creationism. The number of people in Britain who identify with non-Christian religions has increased, with Muslims now accounting for 4.8 per cent of the population, an increase from 3.0% in 2001. Other non-Christian religions together account for 4% of the population (ONS, 2012). Concern about Islamic creationism has been voiced in the mainstream media (e.g. (Gardham, 2008; BBCNews, 2011) and in scientific publications (Hameed, 2008; Koenig, 2001; Curry, 2009; Graebsch and Schiermeier, 2006). However, there is very little empirical data available concerning attitudes to evolution amongst Muslims in Britain.

The number of people who report they have no religion has increased in Britain, whilst the oldest and largest organized religions in Britain – Anglican and Catholic Christianity – have experienced significant declines in the past few decades. Currently 19.5% of the British population identify as Anglican, and 8.8% identify as Catholic (British Social Attitudes 2009-2013).

Against a backdrop of general decline in Christianity, growth is reported amongst Pentecostal churches (currently attended by around 0.7% of the British population) and what we hereafter refer to as "Independent Evangelical" churches, a category consisting of free, independent and non-denominational evangelical churches (currently attended by around 0.6% of the population) (Brierley, 2014).

One study reveals that amongst churchgoers in England, denomination is a significant predictor of evolution rejection, with Pentecostals and Evangelicals more likely to reject evolution than Anglicans or Methodists (Village and Baker, 2013). Allgaier (2014) speculates that the higher levels of creationist beliefs found in London relative to the rest of Britain are due to the large numbers of African and African-Caribbean Pentecostal churches in London (Allgaier, 2014).

However, no previous studies examine attitudes to evolution amongst these different religious and non-religious groups in Britain; nor do previous studies compare predictive factors associated with evolution acceptance and rejection across all these different groups.

Research questions

In this paper, we set out to address a number of specific questions which we believe will contribute to the existing literature.

First, we build on previous poll data to present a more comprehensive picture of attitudes to evolution in Britain by designing a survey instrument that covers a number of different beliefs related to evolutionary theory and various forms of "creationism". We therefore include items covering plant and animal evolution, human evolution, age of the earth, descent from Adam and Eve, and whether natural processes can account for the complexity of life. By including each of these as separate items, we avoid creating categories that make assumptions about the combinations that people might select.

Secondly, we build on previous research to explore the effects of religion and education on acceptance of evolution within the general population, and how these two variables interact with each other. Furthermore, we include a variable for the specific type of secondary school attended (religiously affiliated or not). Important controls are frequency of service attendance age 11 or 12 (as a proxy for religious upbringing), participation in supplementary religious education, general education level, specific education in biology or evolution, and a number of sociodemographic control variables.

Thirdly, we examine the effects of these factors across six specific subpopulations: Anglicans and Catholics, the historically largest religious groups; and Muslims, Pentecostals,

Independent Evangelicals and the Non-Religious, four groups which are currently showing growth in Britain.

We hope that, taken together, these data will provide some insight into the question of whether or not there is a rise in creationism in Britain, and if so, what the reasons might be.

Data and methods

Survey Instrument

The survey questions about evolution were developed with the aim of better representing the general public's views on evolution. Participants responded to a series of statements about evolution using a five-point Likert scale instead of being required to select from a limited choice of pre-determined categories.

TABLE 1 HERE

Sample

We commissioned the polling company YouGov to conduct a survey of a nationally representative sample of the British population, which was undertaken in August 2014. YouGov use a purposive active sampling methodology to select subsamples from their online access panel of more than 360,000 British adults that are nationally representative of British adults in terms of age, gender, social class and newspaper readership (see (Rivers, 2006; Twyman, 2008)). Only individuals in the selected subsample of the panel are invited to take the survey. Respondents are not given the subject of the survey when invited to take part and an incentivisation system helps ensure that people who are not interested in the subject nonetheless complete the entire survey. YouGov weight the final data by age, gender, social class, region, level of education and how respondents voted at the previous election to the national profile of all adults aged 18+ (including people without internet access). There has been much discussion recently about the use of online nonprobability samples, but a recent study by the Pew Research Center suggests that probability samples are not necessarily superior to nonprobability samples, mainly due to the high nonresponse rates seen in probability-based surveys (Kennedy et al., 2016). The Pew study also found that there were considerable differences between different vendors' nonprobability samples, with YouGov's sample performing best (Rivers, 2016).

In addition to a nationally representative sample, there was oversampling of five different religious affiliations: 1) Anglicans (or Episcopalians) 2) Catholics 3) Muslims 4) Pentecostal Christians and 5) Independent Evangelical Christians. Oversampling of the religious groups was achieved by using responses to a pre-screening question: Do you regard yourself as belonging to any particular religion? [If yes] Which of these do you belong to? Answer categories included: Church of England/Anglican/Episcopal; Roman Catholic; Pentecostal (e.g. Assemblies of God, Elim Pentecostal Church, New Testament Church of God, Redeemed Christian Church of God); Evangelical – independent/non-denominational (e.g. FIEC, Pioneer, Vineyard, Newfrontiers); and Islam/Muslim. Although African Pentecostalism has received much attention in the literature recently, it should be noted here that 56% of the Pentecostal sample give their ethnicity as White British.

The five religious samples were weighted for age, gender and social class[1] and pooled with the nationally representative sample. For whole sample analyses, cases were weighted for religious group to ensure that the proportions in our 'whole sample' matched the proportions of those religious groups found within the adult population at large (Anglican 19.5%; Catholic 8.76%; Muslim 3.9% (age 18+); Pentecostal Christian 0.7%; Independent Evangelical Christian 0.6%; All others 65.64%. Source: BSA 2009-2013 and English Church Census 2005)).

In order to identify a genuinely secular category for comparative purposes, cases were allocated to the "Non-Religious" category on the basis of both affiliation (no religious affiliation) and attendance (attendance at religious services about once or twice a year or less). All other cases were allocated to an "Other" category, which cannot itself be analyzed but is necessary to ensure proper composition of the religious groups which are used in the analyses. Although using online access panels falls short of the ideal for generating samples of the minority religious groups under study, it would have been prohibitively expensive to generate new probability samples for this survey.

Measures

Dependent Variable.

The responses to the eight Likert-scale items presented in Figure 1 reveal that public attitudes to evolution are complex and cannot be measured satisfactorily with a single dichotomous measure. Factor analysis of the eight variables produces somewhat different results for each religious group. What all of the results share, however, is a high loading of items 2, 3 and 5

(in italics in Table 1) on the primary factor[2]. The dimension identified in this way also corresponds closely with a biological understanding of evolutionary theory[3] and omits items that are specific only to particular religious traditions. Because additive scales generally have higher validity and increased reliability compared to single dichotomous measures, we created an additive, unidimensional scale of biological evolution acceptance – hereafter referred to as 'EvoScale' – that combines responses to items 2, 3 and 5. We use this scale as the dependent variable in regression analyses. Each item for EvoScale was recoded as follows: Strongly agree = 2, Agree = 1, Neither agree nor disagree = 0, Disagree = -1 and Strongly disagree = -2. The three items were summed to produce a scale ranging from -6 to +6. Cronbachs Alpha for the scale is .898 for the whole sample[4].

Independent Variables.

Religion:

Religiosity was assessed using measures of religious affiliation (see Sample section above) and religious participation. Religious participation was measured using a standard question for frequency of religious service attendance, and was treated as a continuous variable. We included frequency of salah prayer (five daily prayers) as an additional measure of religiosity for Muslims, recognizing that mosque attendance is strongly related to gender and does not measure Muslim piety in the way that church attendance measures Christian piety (El-Menouar, 2014). Salah prayer frequency for all non-Muslims was coded as 1 = never perform salah prayer. We did not include a variable for belief in God in our regression model because we wished to examine socialization effects on attitudes to evolution, rather than using beliefs to explain other beliefs.

Religious upbringing was assessed using two questions: Firstly using a variant of the standard attendance question: What about when you were around eleven or twelve, how often did you attend religious services then? And secondly, by asking respondents whether they had participated in supplementary religious education age 18 or under: 'Did you regularly attend evening/weekend religious classes or activities when you were growing up? (e.g. Sunday School, Catechism Classes, Madraseh, Youth Programme etc) If so, at approximately what ages did you start and finish attending these?' The number of years spent in supplementary religious education was calculated and coded into four categorical variables: Never; 0-5 years; 6-10 years; and 11-18 years, which were then coded as binary variables using 'Never' as the reference group.

Education:

The YouGov education variable records the highest level of educational qualification that respondents have attained. This information was recoded into four categories: 1=No formal qualifications 2=School qualifications 3=Undergraduate and 4=Postgraduate and then coded as binary variables using Group 2 (School qualifications) as the reference group.

The religious affiliations of their secondary school were coded as binary variables (Anglican, Catholic, Independent Christian, Islamic, Jewish, Hindu and Other) using 'No Religious Affiliation' as the reference group. Country of secondary school attendance was coded as a binary variable, Attended school in UK (age 11-16) = 1.

Binary variables were created for Studied Biology at A-Level (age 16-18), Studied Biology at University, and Studied Evolution at University.

Sociodemographic data [5]:

Age and household income were coded as continuous variables. Gender was coded as a binary variable with male = 1. Children in household was coded as a binary variable with one or more children = 1. Marital status was coded as a binary variable with Never Married = 1. Partisanship was coded as a binary variable with Voted Conservative (in 2010 election) = 1.

Results:

FIGURE 1 HERE

The results from the eight Likert-scale items about evolution are shown as bar charts in Figure 1. The first bar shows data for the whole sample, followed by data for each of the different religious affiliations under study: the Non-Religious, Anglicans, Catholics, Muslims, Pentecostals and Independent Evangelicals. The Non-Religious category consists of individuals who express no religious affiliation and who only attend religious services about once or twice a year or less.

Results for the whole sample show that 77.8% agree or strongly agree that plants and animals have evolved from simpler life forms, with only 6.5% actively disagreeing with the statement. Levels of acceptance of human evolution, as we might expect, are a little lower: 66.1% strongly agree or agree that humans evolved from non-human life forms, a figure similar to that obtained in the Theos survey (Lawes, 2009). Although the percentages are higher, the same pattern is evident amongst the Non-Religious group too: 84.1% accept plant and animal evolution whereas only 75% accept human evolution. Anglicans are virtually

indistinguishable from the Non-Religious for these two survey items (85.8% accept animal and plant evolution; 72.6% accept human evolution), whilst acceptance amongst Catholics is just slightly lower at 80.3% and 63.6% respectively. Acceptance is lowest amongst Pentecostals, followed by Independent Evangelicals, then Muslims. In the whole sample, 69.1% agreed that there is strong, reliable evidence to support the theory of evolution, with only 3.3% disagreeing.

What about those who reject evolution? In the whole sample, 11.6% disagree or strongly disagree with human evolution, whilst 6.5% reject plant and animal evolution. Rejection of human evolution is highest amongst the Independent Evangelical and Pentecostal Christian groups (who together make up just over 1% of the population), followed by Muslims – although a large proportion (28.9%) of Muslims opt for the 'neither agree nor disagree' category. 3.8% of the whole sample appear to subscribe to the 'human exceptionalist' view of evolution (see (Miller et al., 2006; Elsdon-Baker, 2015)) – that is, accepting the evolution of plants and animals whilst rejecting human evolution. 12.5% of Pentecostals, 12.6% of Independent Evangelicals, 10% of Muslims, 4.2% of Anglicans, 6.3% of Catholics and 2.0% of Non-Religious hold this view.

Only 4.8% of respondents in the current study reject the notion of an ancient earth that is billions of years old whilst, rather inconsistently, 6.1% agree with the idea of a young earth less than 10,000 years old. A slightly higher proportion of 10.6% agreed that the world was created in six 24-hour days. A cross-tabulation (not shown) of the question about human origins with the question about a young earth shows that although 6.1% of respondents could be classified as "young earthists", only 2% could rightly be called "young earth creationists", that is, they accept the idea of a young earth less than 10,000 years old *and also* reject human evolution. A slightly higher figure of 4.2% agree that the world was created in six 24-hour days and also reject human evolution.

These figures are interesting because they show that the proportion of respondents who hold some sort of consistent Young Earth Creationist position is very much lower than the 17% or 22% of respondents opting for the Young Earth Creationism category in the Theos survey (Lawes, 2009) or the BBC Horizon survey (BBCNews, 2006) respectively. A further point to note is that a large proportion of the whole sample (one-third) select 'neither agree nor disagree' in response to the age of the earth questions, and that similar proportions select this response across all religious groups and also the non-religious group. General education levels are lower amongst those who 'neither agree nor disagree' that the earth is billions of years old, with a smaller proportion having university-level qualifications (38.6%),

compared with those who reject an ancient earth (47.3%), and those who accept an ancient earth (53.1%). These observations suggest that it is largely lack of knowledge rather than religiosity that accounts for the uncertainty regarding the age of the earth. The proportion of people who confidently hold a consistent "old earth evolutionist" position – actively accepting plant and animal evolution, human evolution and an earth that is billions of years old – is relatively low at 50% of the whole population. Even amongst the Non-Religious, only 58% confidently hold an "old earth evolutionist" position; presumably this figure has little or nothing to do with religious beliefs amongst this population but simply reflects a lack of knowledge. It is also a little surprising that amongst the Non-Religious group (bearing in mind that our categorization for the Non-Religious was fairly stringent, based on both religious affiliation *and* frequency of religious service attendance), only 66.7% disagree that the world was created in six 24 hour days, 70% disagree that the whole human race is descended from Adam and Eve and 50.3% disagree that life is too complex to have evolved solely by natural processes.

Although 66.1% of the whole sample agree that humans evolved from non-humans, only 54.9% disagree that the whole human race is descended from Adam and Eve. Cross-tabulation shows that 6.2% of the sample accept human evolution *and* agree that the human race is descended from Adam and Eve. Belief in an ancestral Adam and Eve is particularly high amongst Pentecostal, Independent Evangelical and Muslim groups.

TABLE 2 HERE Descriptive statistics for Evoscale.

We used EvoScale (see Methods for details) as the dependent variable in an OLS linear regression model [6]. Descriptive statistics for EvoScale are shown in Table 2 and descriptive statistics for the independent variables are available in Table S1 in supplementary online information. The groups with the lowest mean EvoScale scores are Pentecostal followed by Independent Evangelical Christians; these values are negative, indicating, on average, a rejection of evolution in these groups. The mean score for Muslims is close to zero, whilst Anglicans, Catholics and the Non-Religious all have a positive mean score.

TABLE 3 HERE

The linear regression model discussed in the following paragraphs is shown in Table 3. It should be noted that the model shown includes interaction effects between religiosity

(frequency of religious service attendance) and education level; however, the main effects in the absence of this interaction will also be described in the text.

Within the whole sample, the religious affiliations that are significantly predictive of a lower evolution acceptance score (using the Non-Religious as the reference category) are Pentecostals, Independent Evangelicals and Muslims – three religious groups that are currently showing growth. But the group that has shown the most growth over the past decades, the Non-Religious, has the highest mean evolution score.

When the Religiosity*Education interaction is omitted (data not shown), for the whole sample we see that possession of university-level qualifications is predictive of a higher evolution score, whilst a lack of formal qualifications predicts a lower score. This same pattern is seen amongst the Non-Religious, Anglicans and Catholics; however general education level is not a significant factor for Muslims, Pentecostals or Independent Evangelicals. Some of these significant main effects are absorbed by the Religiosity*Education interaction.

Frequency of religious service attendance is a large significant predictor of evolution rejection for the whole sample, and amongst most of the religious groups. In the absence of the Religiosity*Education interaction, the effect is particularly strong amongst Independent Evangelicals and Pentecostals, the two religious affiliations associated with the lowest mean evolution scores.

The interaction between Religiosity and Education is not significant in the whole sample, but it is highly significant amongst Anglicans and Muslims [8], and also significant amongst Catholics and Pentecostals [7]. Simple slopes analysis reveals that for Anglicans, low education has an especially negative effect on EvoScore, but at high levels of education, degree of religiosity is associated with only small differences in EvoScore. A similar effect is seen for Catholics. For Muslims the situation is reversed. At low levels of education, religiosity makes little difference to acceptance of evolution. At high levels of education, however, EvoScore diverges with religiosity. Muslims who are highly educated but not very religious are likely to accept evolution. Those who are highly educated and also highly religious are especially likely to reject it.

Biology education at A-Level (post-16) predicts a higher score only for Catholics and Evangelicals, whilst university-level Biology is not a significant predictor for any group, because all variation is predicted instead by the variable Studied Evolution at university, which is significant across all groups except Independent Evangelicals.

Attending school in the UK (age 11-16) predicts a higher EvoScore within the whole sample, which is unsurprising given that secondary education is compulsory, available free of cost, and, at least in recent decades, almost certainly includes teaching of evolutionary theory. The Pentecostal and Muslim groups contain the largest proportions of people who did not receive secondary education in the UK (26% and 28% respectively), the majority of whom will be first-generation immigrants. For Pentecostals, attending secondary school in the UK is one of the largest positive predictors of a higher EvoScore; however, for Muslims this variable is insignificant.

Given the current debates surrounding the teaching of evolution following recent changes in government education policy, it is of considerable interest to examine whether schooling in a "faith school" is predictive of evolution acceptance score (unweighted counts in brackets). Amongst the whole population, attendance at an Islamic (n = 204) school compared to attendance at a school with no religious affiliation predicts higher acceptance of evolution even though Muslims as a group score lower than the whole population. Amongst Muslims (n = 803), attendance at an Islamic school (n = 166) is the largest predictor of a higher evolution score. A similar, although smaller and less significant effect is seen amongst Independent Evangelicals (n = 540), for whom attendance at a Catholic school (n = 27) is predictive of a higher evolution score. It is of note that that faith schooling is predictive of a higher evolution acceptance score only amongst religious groups with low mean scores for evolution acceptance. It is not the case that mean EvoScores for Muslims or Independent Evangelicals who attended Islamic or Catholic schools, respectively, are strongly positive; rather it is that their EvoScores are less negative than the equivalent scores of those who attended a secular school. Thus faith school attendance among these groups predicts less strong rejection of evolution rather than active acceptance.

Within the whole sample, regular attendance at religious classes or activities (age 18 and under) is predictive of a small increase in EvoScore, and the same is seen in the Non-Religious group. It is predictive of a lower score amongst Catholics, even though the official Catholic position does not reject evolution, and Catholic affiliation is not predictive of a lower evolution score. It is also predictive of a lower score amongst Muslims, although it is important to note here that religious service attendance age 11 or 12 – as a proxy for religious upbringing – is a less satisfactory control variable for Muslims than Christians. Intriguingly, regular attendance at religious classes or activities is quite strongly predictive of a higher EvoScore amongst Independent Evangelicals, even though the mean score for this group is low.

Interestingly, age is not significantly predictive of attitude to evolution in these models, except for Pentecostals, for whom increased age is significantly predictive of a lower evolution score. Unfortunately it is not possible to tell from these data whether this is a life-cycle effect or a cohort effect (a difference between generations).

In the United States, political conservatism (support for the Republican party) is strongly predictive of evolution rejection. This study shows that in Britain no such link exists in the population as a whole nor amongst any of the religious groups surveyed. In fact, Anglicans have the largest proportion of Conservative voters but also one of the highest mean EvoScores.

Discussion

Our study makes a number of contributions to this area of research. We provide strong evidence that the number of "creationists", particularly "young earth creationists" has been greatly overstated in previous polls carried out in Britain. We find that only 2% of the British population adhere to the Gallup-poll-question type of creationism, that is, a position requiring both rejection of human evolution and acceptance of a young earth. We find that many people hold unconfident or inconsistent views regarding evolution, with similar levels of uncertainty about the age of the earth found across religious and non-religious groups. The problematic construction of poll questions about evolution combined with a lack of knowledge amongst publics likely explains why results from some polls show a relatively high number of young earth creationists in Britain. These commonly-used answer categories have probably also masked the fact that those who do select an 'evolution' category may know or understand little about the theory, particularly regarding the age of the earth.

Although it is not possible to say definitively whether rejection of evolution is increasing, this study does offer some indicative data. The largest and fastest-growing group examined in this study – the Non-Religious – also have the highest mean EvoScore, suggesting that acceptance of evolution may actually be increasing, or at least remaining steady. However, what we may well be witnessing is a decline in the proportion of religiously-affiliated people who accept evolution, given that the lowest EvoScores are found amongst the religious groups showing growth, and the highest EvoScores amongst those religious groups in decline.

Based on results from this study, we suggest that rather than witnessing an actual increase in the proportion of people with creationist beliefs in Britain, we have instead seen

an increased *visibilisation* of creationism, and that this has been driven in part by concerns about immigration, particularly Muslim immigration. As Salman Hameed observes, it is "only a rejection of evolution by Muslims [that] makes for a news item as that feeds into the existing narrative of "problems" of Muslim integration into a secular West" (Hameed, 2015). Despite fears about Islamic creationism, we find that the issue of evolution does not seem particularly salient for Muslims in Britain, with more Muslims than any other group selecting the 'neither agree nor disagree' option for the eight Likert-scale items about evolution. A recent ethnographic study of Sunni and Evangelical high schools in the U.S. similarly concluded that the subject of evolution is not "morally salient" for Muslims in the way it is for Evangelical Christians (Guhin, 2016). However, we do consider it possible that the recent visibilisation of Islamic creationism may have increased the salience of the issue for British Muslims, and that this could lead to an increased identification with creationist beliefs in the future, a suggestion in line with the concerns about "creating 'Islamic Creationists'" voiced by Elsdon-Baker (2015).

We found that religious affiliation and attendance – or salah prayer frequency for Muslims – together with education were key predictors of the acceptance or rejection of evolution, supporting other research (Village and Baker, 2013; Miller et al., 2006; Haider-Markel and Joslyn, 2008; Baker, 2013). We also found that among those faith-groups with low average evolution scores, scores were higher if individuals had attended a faith school. This suggests that for people from particular faith backgrounds, teaching evolution in a faith-based context may lead to greater acceptance or less strong rejection of evolutionary theory than when taught in a secular context.

How might this finding be explained? One possibility is that some individuals who have attended private faith schools simply may not have encountered evolutionary theory. It is plausible that such individuals would score higher on the EvoScale compared to those from a similar background who have learnt about evolution and have consciously decided to reject it. Another possibility is that teachers in faith schools may feel more confident or better equipped to help students navigate the relationship between evolutionary theory and religious beliefs. A further possibility is that students who perceive they are a religious minority within their educational context may be more likely to develop a strengthened and possibly oppositional (Ogbu, 1995) or adversarial (Portes and Zhou, 1993) religio-cultural identity. If, additionally, students have only encountered the idea of belief in God and evolution as binary opposites, then rejection of evolution may become a marker of religious identity that cannot easily be discussed or challenged in the classroom.

Why, amongst Muslims in Britain, does the combination of high education and high religiosity correspond with the lowest levels of evolution acceptance? One could argue that highly educated and highly religious Muslims are simply more aware of an epistemological clash between their religious beliefs and evolutionary biology. However, we would be sceptical of such a generalisation given that Muslim elites historically have differed considerably in their views of evolution. Furthermore, a small study of highly educated Muslims in a different context – Pakistani doctors in the US – found no correlation between religiosity and evolution acceptance (Everhart and Hameed, 2013), so it would be of great interest to explore the relationship between religiosity and education amongst Muslims in other contexts. Given our finding that Muslims who have attended secular secondary schools are less accepting of evolution, we suggest it could be significant that most of the Muslim graduates in our sample will have spent several years in the secular educational setting of a British university. Any future studies of Muslim students' views of evolution should be sure to pay close attention to students' broader experiences at university, including feelings of alienation or inclusion, participation in student societies, and engagement with various information sources.

Another result from this study that requires explanation is that Supplementary Religious Education (evening or weekend religious classes or activities age 18 or under) is a strongly positive predictor of evolution acceptance for Independent Evangelicals, even though acceptance of evolution is low on average in this group. We speculate this could be because many evangelical churches employ a dedicated youthworker/minister who is likely to uphold traditional youth work values of informal education, voluntary participation and young people's choice (Stanton, 2013; Shepherd, 2010). This emphasis on choice means that Independent Evangelicals who have attended youth activities at evangelical churches may be more likely to have encountered and discussed a range of possible theological positions regarding creation and evolution, rather than being taught that one particular view is correct.

Whilst not wishing to use the findings from our study to advance a more general argument in favour of faith schools, they do raise interesting questions about the experiences of religious young people learning about evolution in non-religious schools, suggesting it is a subject worthy of further investigation. These findings are particularly important given recent and current debates in the UK regarding education policies, faith schools and the teaching of evolution. This study adds to the growing body of evidence demonstrating that a deficit model approach of simply supplying more information or education about evolution may not produce the results desired by anti-creationist lobbying groups.

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Footnotes

[1] The Muslim sample was weighted for age, gender and social grade to the 2011 Census data for Muslims. Anglican and Catholic samples were weighted for age, gender and social grade to data for Anglicans and Catholics respectively, averaged from five years' (2009 – 2013) of the British Social Attitudes (BSA) survey. The Pentecostal sample was weighted for social grade to the BSA 2009-2013 (whole population) and for age and gender to the English Church Census 2005 for Pentecostals. The Independent Evangelical sample was weighted for social grade to the BSA 2009-2013 (whole population) and for age and gender to the English Church Census 2005 for "Independent" and "New Churches" categories averaged.

[2] Factor analysis of the eight items for each religious group separately showed that items load onto one component for Non-Religious and Independent Evangelicals, two components for Anglicans and Pentecostals, and three components for Catholics and Muslims. Items 2, 3, 4 and 5 load onto the same component for all six of the groups and are the four highest loading components except for Independent Evangelicals, for whom Item 7 loads higher than Item 4. We therefore conclude that there is one dimension common to all groups under study, consisting of items 2, 3 and 5.

[3] The concept of deep geological time is also central to the scientific theory of evolution. However, amongst general publics, large numbers of people appear to be unsure about geological timescales (see Figure 1.6 and 1.7), explaining in part why the items about the age of the earth fail to hang together with other items central to evolutionary theory.

[4] Alpha values for EvoScale broken down by religious group are: Non-Religious = .888, Anglican = .849, Catholic = .864, Pentecostal = .849, Independent Evangelical = .881, Muslim = .780.

[5] We also tried including including ethnicity as an independent variable. However, results were mostly insignificant, or *n* for the ethnic group concerned was extremely small.

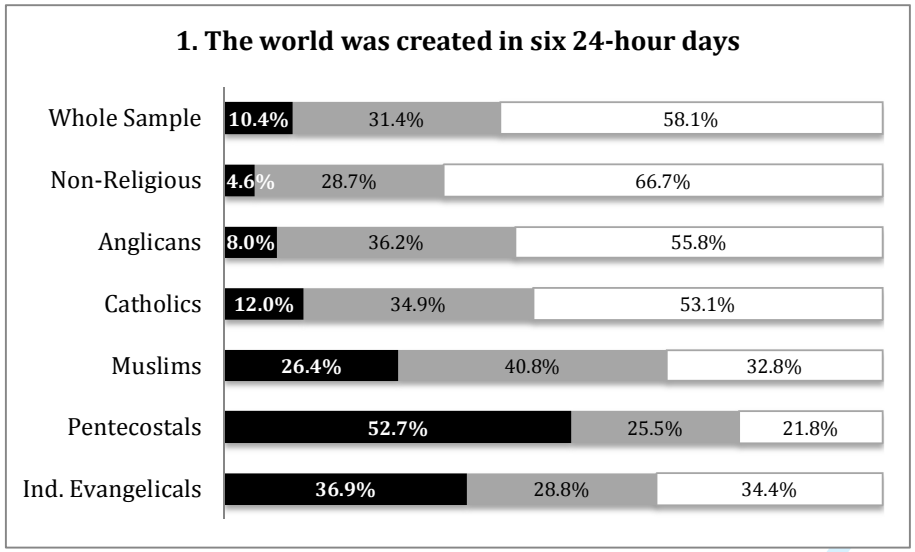
Pentecostals are the most ethnically mixed religious group in this study, but ethnicity was not a significant predictor of EvoScore for this group.

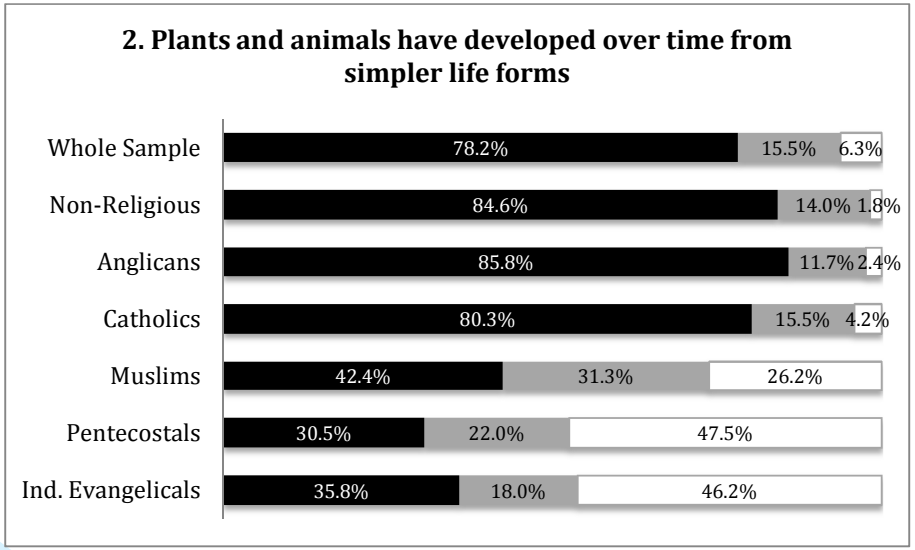
[6] Although we present here results from regression analyses using the scale variable EvoScale, we did also try regression analyses using responses to the single item about human evolution (Item 3). Results from both analyses showed similar patterns.

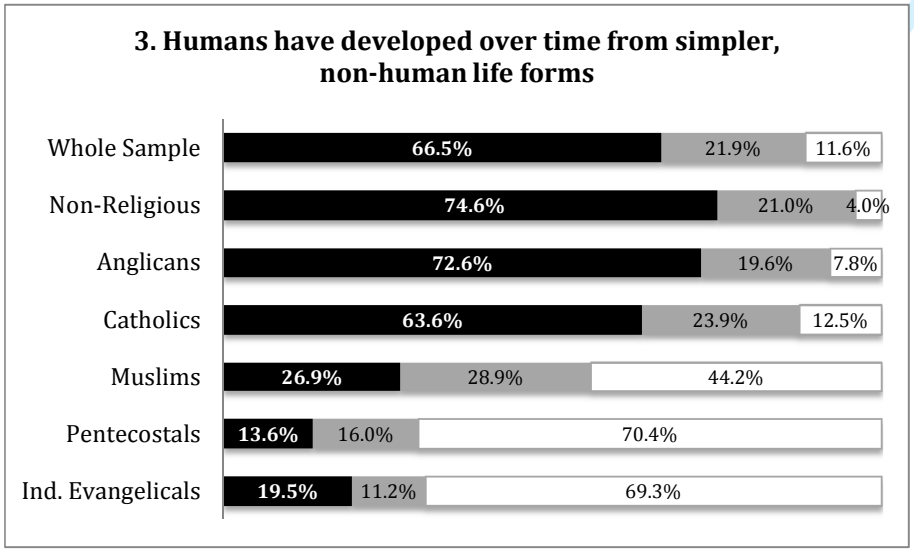
[7] We also confirmed that these interaction effects held true in a much simpler regression model in which only age, gender, education and attendance were included as independent variables.

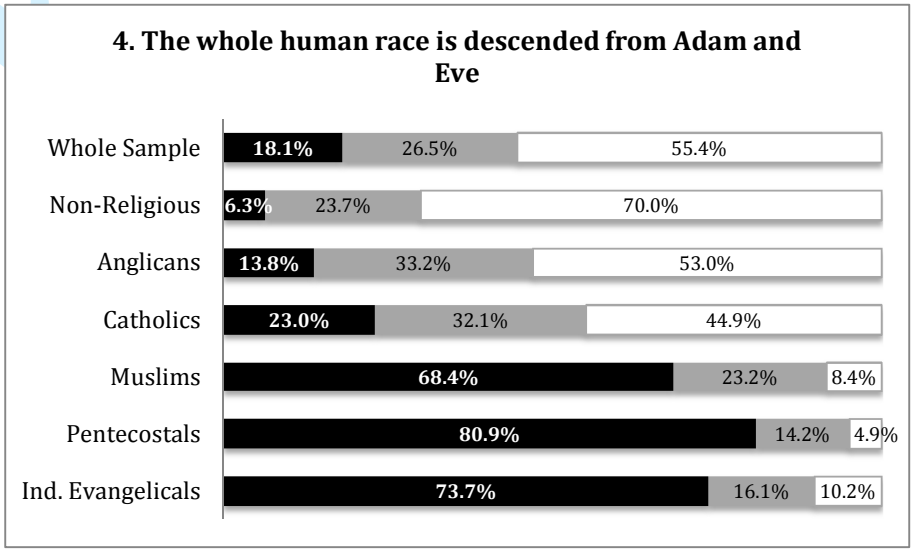
[8] It was necessary to examine the Religiosity*Education interaction in the absence of the Salah Prayer variable (included in the model as an additional measure of religiosity for Muslims). The same pattern was seen when we examined Salah Prayer * Education (in the absence of Religious Service Attendance).

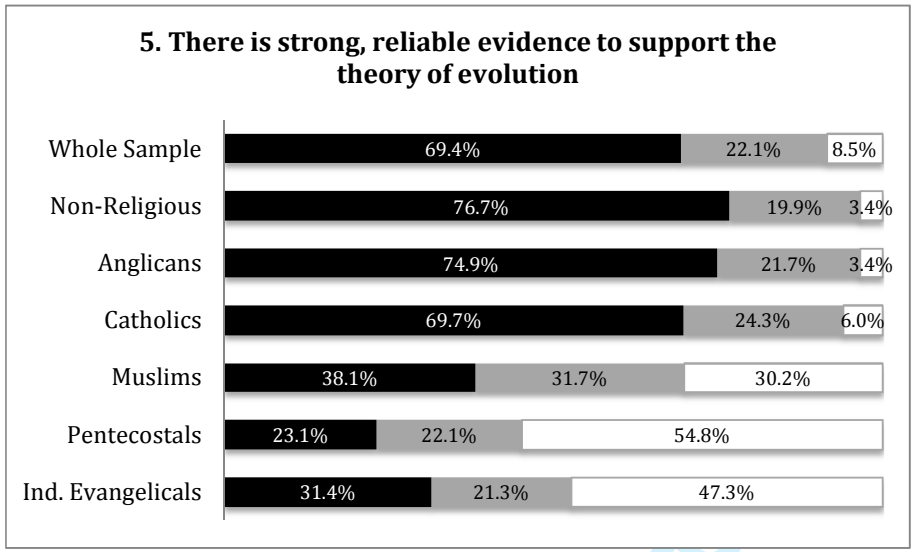
Figure 1) 1-8: Results from the eight Likert scale items about evolution. Black = Strongly agree or Agree; Grey = Neither agree nor disagree; White = Disagree or Strongly disagree.

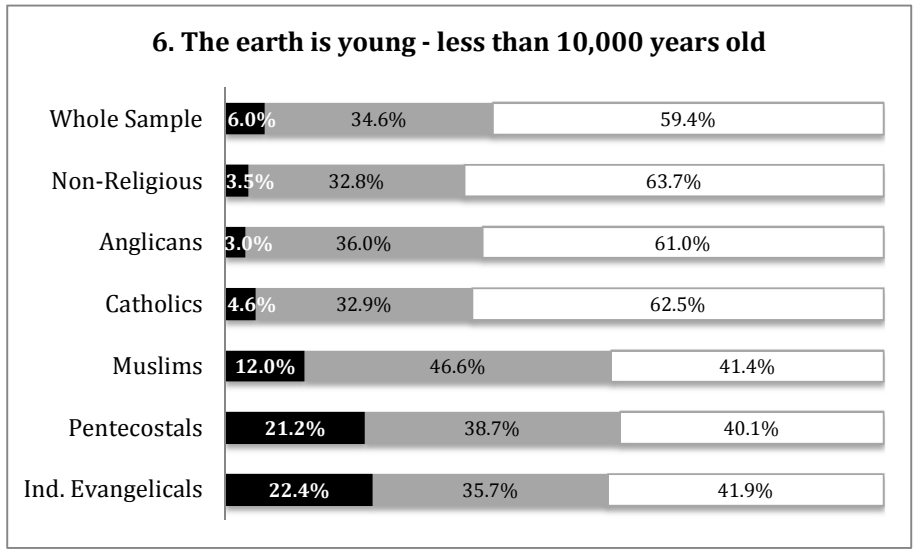


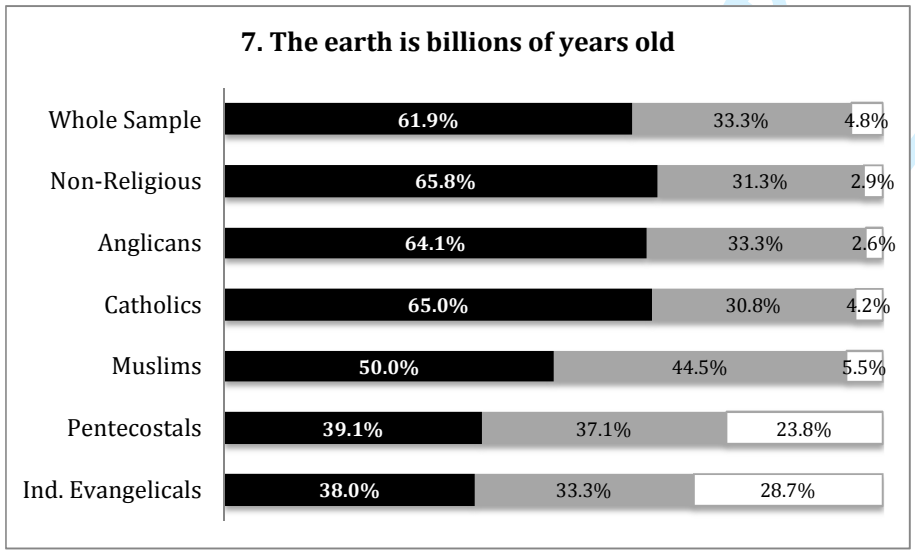


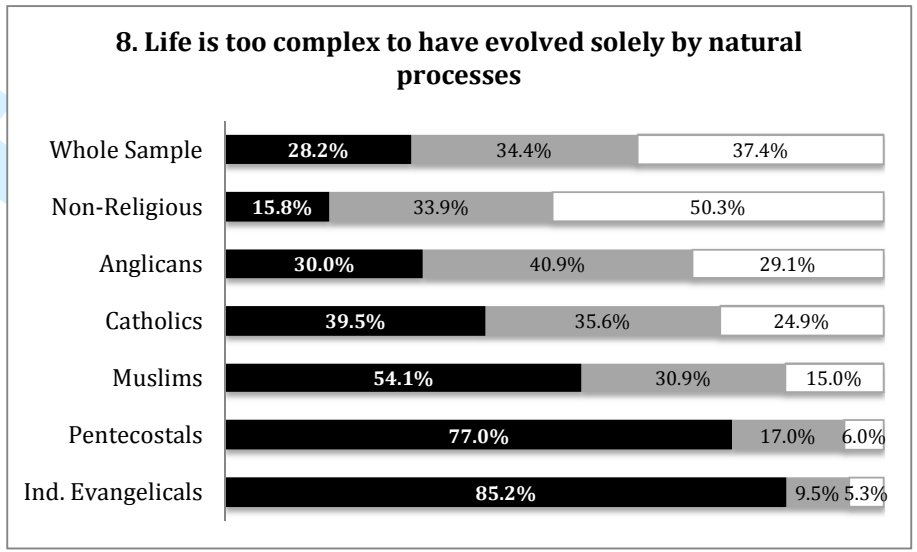





5. There is strong, reliable evidence to support the theory of evolution
Whole Sample
69.4%
22.1%
8.5%
Non-Religious
76.7%
19.9%
3.4%
Anglicans
74.9%
21.7%
3.4%
Catholics
69.7%
24.3%
6.0%
Muslims
38.1%
31.7%
30.2%
Pentecostals
23.1%
22.1%
54.8%
Ind. Evangelicals
31.4%
21.3%
47.3%


6. The earth is young - less than 10,000 years old
Whole Sample
6.0%
34.6%
59.4%
Non-Religious
3.5%
32.8%
63.7%
Anglicans
3.0%
36.0%
61.0%
Catholics
4.6%
32.9%
62.5%
Muslims
12.0%
46.6%
41.4%
Pentecostals
21.2%
38.7%
40.1%
Ind. Evangelicals
22.4%
35.7%
41.9%


7. The earth is billions of years old
Whole Sample
61.9%
33.3%
4.8%
Non-Religious
65.8%
31.3%
2.9%
Anglicans
64.1%
33.3%
2.6%
Catholics
65.0%
30.8%
4.2%
Muslims
50.0%
44.5%
5.5%
Pentecostals
39.1%
37.1%
23.8%
Ind. Evangelicals
38.0%
33.3%
28.7%


8. Life is too complex to have evolved solely by natural processes
Whole Sample
28.2%
34.4%
37.4%
Non-Religious
15.8%
33.9%
50.3%
Anglicans
30.0%
40.9%
29.1%
Catholics
39.5%
35.6%
24.9%
Muslims
54.1%
30.9%
15.0%
Pentecostals
77.0%
17.0%
6.0%
Ind. Evangelicals
85.2%
9.5%
5.3%

For each of the following statements, please say whether you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree:

1. The world was created in six 24-hour days
2. Plants and animals have developed over time from simpler life forms
3. Humans have developed over time from simpler, non-human life forms
4. The whole human race is descended from Adam and Eve
5. There is strong, reliable evidence to support the theory of evolution
6. The earth is young - less than 10,000 years old
7. The earth is billions of years old
8. Life is too complex to have evolved solely by natural processes

Table 1 The eight Likert-scale items about evolution included in the survey instrument. Items 2, 3 and 5 (in italics) were used to create 'EvoScale', the dependent variable used in the multiple regression analysis.

	N	Min	Max	Mean	Std. Deviation
Whole sample	6020	-6	6	2.7964	2.85391
None	1633	-6	6	3.5592	2.38721
Anglican	1247	-6	6	3.0801	2.22808
Catholic	978	-6	6	2.6267	2.47546
Muslim	815	-6	6	-0.1495	3.12254
Pentecostal	322	-6	6	-1.8996	3.1813
Independent Evangelical	532	-6	6	-1.4543	3.52604

Table 2 Descriptive Statistics for EvoScale, for whole sample and for each religious group.

	Whole Sample (n = 6020)	Religious Affiliation					
		Non-Religious (n = 1633)	**Anglican** (n = 1247)	**Catholic** (n = 978)	**Muslim** (n = 815)	**Pentecostal** (n = 322)	**Independent Evangelical** (n = 532)
Religious Factors							
Religious Affiliation							
Non-Religious (ref.)	--	--	--	--	--	--	--
Anglican	0.004	--	--	--	--	--	--
Catholic	-0.013	--	--	--	--	--	--
Muslim	-0.124**	--	--	--	--	--	--
Pentecostal	-0.108**	--	--	--	--	--	--
Independent Evangelical	-0.093**	--	--	--	--	--	--
Other Religion	-0.191**	--	--	--	--	--	--
Religious Service Attendance	-0.305**	-0.151	-0.404**	-0.423**	-0.305*	-0.699**	-0.238
Religious Service Attendance age 11 or 12	0.01	0.025	-0.024	0.026	0.048	0.027	-0.005
Frequency of Salah Prayer	-0.07**	--	--	--	-0.263**	--	--
Attendance at regular religious classes							
Never (ref.)	--	--	--	--	--	--	--
0-5 years	0.03**	0.068**	0.009	-0.048	-0.057	0.067	0.105**
6-10 years	0.016	0.022	0.049	-0.088**	-0.109**	-0.026	0.128**
11-18 years	0.022	0.032	0.019	-0.036	-0.085*	-0.038	-0.073
Educational Factors							

Education Level							
School-Level Qualifications (ref.)	--	--	--	--	--	--	--
No formal qualifications	-0.068**	-0.061*	-0.08**	-0.07*	-0.044	0.172*	0.016
Undergraduate	0.094**	0.117**	0.1**	0.05	0.078	-0.134	0.149
Postgraduate	0.091**	0.119*	0.033	0.023	0.142*	-0.36	0.232
Attended school in the UK (age 11-16)	0.048**	0.032	-0.018	0.061	0.024	0.195**	0.061
Religious Affiliation of school attended age 11-16							
No religious affiliation (ref.)	--	--	--	--	--	--	--
Anglican	-0.014	0.002	-0.067*	-0.003	0.047	0.089	0.052
Catholic	0	-0.021	-0.003	-0.025	0.016	0.03	0.093*
Ind. Christian	-0.017	-0.036	-0.024	-0.009	0.054	0.011	-0.01
Islamic	0.065**	-0.015	--	--	0.169**	-0.002	--
Jewish	0.001	-0.031	--	--	--	-0.045	--
Hindu	0.024*	--	--	--	-0.01	--	--
Other	0.02	0.016	0.004	-0.009	-0.011	0.049	-0.007
Studied Biology at A-Level	0.040**	0.043	-0.007**	0.169**	0.055	-0.031	0.104*
Studied Biology at University	0.02	0.033	0.008	-0.026	0.002	0.075	0.037
Studied evolution at University	0.07**	0.083**	0.133**	0.113**	0.066	0.182**	-0.037
Interactions							

Education Level * Religious Service Attendance	0.031	0.014	0.299**	0.281*	-0.414**	0.596*	-0.176
Demographic and Political Factors							
Voted Conservative 2010 election	-0.008	-0.001	0.011	-0.032	0.056	-0.042	-0.053
Age	-0.002	-0.001	0.045	0.073	0.018	-0.177**	-0.069
Male	0.092**	0.145**	0.077**	0.099**	0.041	-0.015	0.089*
Gross household income	-0.008	-0.030	0.023	0.028	-0.011	0.05	0.076*
Children in household (≥ 1)	-0.055**	-0.077**	-0.005	0.037	-0.11**	-0.016	-0.018
Never married	-0.01	-0.005	-0.049	-0.041	0.019	0.015	-0.03
R^2	.272	.111	.114	.148	.189	.259	.217

Table 3 Multiple regression showing standardized β values for each independent variable using EvoScale as the dependent variable. *p < .05, **p < .01.

	Range	Whole Sample (n = 6020)	Religious Affiliation					
			Non-Religious (n = 1633)	**Anglican** (n = 1247)	**Catholic** (n = 978)	**Muslim** (n = 815)	**Pentecostal** (n = 322)	**Independent Evangelical** (n = 532)
Religious Factors								
Religious Affiliation								
Non-Religious	0-1	.513	1	0	0	0	0	0
Anglican	0-1	.199	0	1	0	0	0	0
Catholic	0-1	.085	0	0	1	0	0	0
Muslim	0-1	.039	0	0	0	1	0	0
Pentecostal	0-1	.007	0	0	0	0	1	0
Independent Evangelical	0-1	.006	0	0	0	0	0	1
Other Religion	0-1	.152	0	0	0	0	0	0
Religious Service Attendance	1-9	2.76 (2.27)	1.49 (.688)	3.11 (2.02)	4.20 (2.54)	5.19 (2.89)	6.85 (2.23)	7.10 (1.91)
Religious Service Attendance age 11 or 12	1-9	4.86 (2.84)	3.93 (.278)	5.56 (2.50)	6.87 (1.95)	5.72 (3.01)	6.57 (2.64)	6.40 (2.58)
Frequency of Salah Prayer	1-6	1.13 (.747)	1 (.000)	1 (.000)	1 (.000)	4.43 (1.70)	1 (.000)	1 (.000)
Attendance at regular religious classes								
Never	0-1	.688	.766	.510	.696	.614	.487	.600
0-5 years	0-1	.121	.105	.187	.094	.112	.229	.071
6-10 years	0-1	.133	.097	.215	.130	.221	.382	.167
11-18 years	0-1	.057	.032	.088	.080	.053	.359	.164

Educational Factors								
Education Level								
No formal qualifications	0-1	.071	.081	.075	.060	.038	.056	.047
School-Level Qualifications	0-1	.426	.455	.414	.383	.401	.313	.313
Undergraduate	0-1	.278	.274	.263	.314	.306	.362	.363
Postgraduate	0-1	.183	.154	.223	.225	.162	.231	.253
Attended secondary school in the UK	0-1	.935	.959	.973	.894	.720	.739	.938
Religious Affiliation of school attended age 11-16								
No religious affiliation	0-1	.469	.497	.417	.175	.560	.570	.660
Anglican	0-1	.321	.332	.540	.099	.108	.195	.233
Catholic	0-1	.133	.115	.014	.706	.035	.089	.054
Ind. Christian	0-1	.029	.024	.020	.010	.031	.088	.038
Islamic	0-1	.020	.009	.000	.000	.210	.016	.000
Jewish	0-1	.005	.003	.000	.000	.000	.002	.000
Hindu	0-1	.001	.000	.000	.000	.004	.000	.000
Other	0-1	.021	.020	.007	.010	.006	.037	.015
Studied Biology at A-Level	0-1	.088	.078	.073	.117	.143	.175	.153
Studied Biology at University	0-1	.019	.019	.013	.025	.032	.021	.025
Studied evolution at University	0-1	.079	.074	.050	.097	.090	.094	.092

Demographic and Political Factors								
Voted Conservative 2010 election	0-1	.294	.263	.486	.266	.122	.241	.365
Age	18-94	48.14 (16.76)	46.24 (16.42)	56.54 (15.10)	47.84 (16.61)	35.98 (13.93)	44.19 (16.76)	47.05 (17.21)
Male	0-1	.468	.513	.488	.491	.501	.500	.481
Gross household income	1-17	9.38 (5.41)	9.21 (5.31)	9.48 (5.32)	9.62 (5.30)	9.48 (6.05)	9.03 (5.26)	9.12 (4.95)
Children in household (≥ 1)	0-1	.295	.277	.215	.289	.605	.431	.330
Never married	0-1	.179	.195	.114	.224	.220	.144	.171

Table S1 Descriptive statistics for all independent variables included in regression models. Standard deviation is shown in brackets for variables treated as continuous variables.