Running head: REJECTING EVOLUTION

Rejecting Darwinian evolution: The effects of education, church tradition, and individual theological stance among UK churchgoers

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Abstract

A sample of 2232 committed churchgoers from a range of churches in the UK completed a questionnaire that included a measure of rejection of Darwinian evolution. Respondents with undergraduate or postgraduate qualifications had slightly lower odds of rejecting evolution than those without degrees, but whether qualifications were in non-biological science, biology or theology made little difference to the likelihood of rejection. Those who attended Anglican or Methodist (AM) churches were much less likely to reject evolution than those who attended Evangelical or Pentecostal (EP) churches, but the effect of education on reducing rejection was similar in both groups. Individual theological conservatism was strongly associated with rejection, but whereas liberals showed declining rejection with increased education, there was no such effect for conservatives. Frequent church attendance and Bible reading both predicted rejection, and the effect of Bible reading was most pronounced among AM churchgoers. Higher education of any kind may reduce the likelihood of rejection of evolution among many UK churchgoers, but theological conservatives from any tradition will tend to maintain their belief that Darwinian evolution does not explain the origin of species whatever their educational experience.

Introduction

Charles Darwin's *Origin of Species* (1859) put forward the idea that complex forms of life evolved from simpler species through evolution driven by natural selection. The merging of this concept with Mendelian genetics and population studies led to the 'Modern Synthesis' in the early twentieth century, which became the cornerstone of evolutionary biology (Gayon 1998). Although some have argued the theory needs extending to accommodate more recent findings (Laland et al. 2015) the basic idea that entirely natural processes explain fully the origin, complexity and diversity of life on earth is almost universally accepted among scientists. Given this overwhelming endorsement of the evolutionary paradigm, it is perhaps surprising that there remain large numbers of people in cultures that have been dominated by science and technology for over two centuries who do not accept this explanation for the origin of species, especially the origin of humans. Although rejection of evolution is found among some non-religious people, it is usually associated with religious beliefs, particularly with the Judeo-Christian and Islamic traditions. The reasons are not hard to find: the Scriptures of these traditions assign the creation of life to the active intervention of God, so rejecting evolution is partly about rejecting the idea that God had no part in creation and, by implication, no control over whether and how human beings came to be (Village and Baker 2013a).

In societies where traditional religious belief is still prevalent, rejection of evolution remains commonplace. In the US, the exemplar of this phenomenon, around 70% of the population affiliates with Christianity (PEW_Research_Centre 2017) and around half the general population rejects evolution (Miller et al. 2006), a figure that has remained fairly constant over the last half century (Newport 2012). In Europe, where Christian affiliation and practice are much lower, rejection of evolution is rarer, occurring in no more than around 15% of the general population in countries such as Denmark, Sweden, France and the UK.

Where it does occur, it is partly (but not wholly) associated with certain religious traditions and particular religious beliefs, notably those related to the Bible. For Christians who believe in the ultimate authority, inerrancy or infallibility of Scripture, the account of creation in Genesis is the framework within which scientific evidence should be interpreted. Creation science (Morris and Parker 1982) is understood by some to be the best interpretation of the available evidence regarding evolution. Literal interpretation of Genesis is also associated with a wider range of beliefs about the relationship of humans to the natural world, including the idea that humans have dominion over creation (Village 2015).

The role of education in shaping beliefs about evolution is complicated. On the one hand, some people have perceived the teaching of Darwinian evolution in school as a threat that undermines religious belief. The famous Scopes Money Trial (Larson [1997] 2006), and more recent debates about the place of creationism in the science curriculum (Baker 2010; Berkman and Plutzer 2010) are predicated on the idea that children and adults may be influenced by what they are taught through formal education. Giving equal status in science lessons to Creationist explanations of the origin of species is thought to be a way of allowing pupils to make their own minds up on the issue, so that some who would otherwise accept Darwinian evolution as the only possible explanation might consider biblical accounts of creation instead. On the other hand, a number of studies have shown that formal education about evolution has rather little effect on what people believe about it (Baker 2013; Hill 2014). The evidence is mixed and outcomes may depend on a range of contextual and individual variables, but overall correlations between scientific literacy or formal education levels and acceptance of evolution are low in studies from the US (Berkman and Plutzer 2010). The politicization of science due to its challenge to religious beliefs and association with wider ideological positions may be the main difference between the US and Europe, and

might explain why scientific literacy has less influence on rejection of evolution (Miller et al. 2006).

Not all religious people reject evolution, so the question remains about what sort of religious affiliation, practices or beliefs predict rejection of evolution, and what sorts of education might lead someone who is religious to accept evolution. Given that it is mainly religious people who reject evolution, this study is based on a convenience sample of regular churchgoers from a range of Christian traditions in the UK who completed questionnaires that included an item assessing acceptance or rejection of evolution alongside items assessing religious practice (attendance and Bible reading), theological stance, and educational experience. The aim was to test hypotheses relating to the effects of religion and education on the rejection of evolution in a country with a minority practicing Christian population where political ideology tends to be separate from religious belief. This paper builds on an earlier study (Village and Baker 2013b) by adding more cases and testing specifically the interactive effects of religion and education on rejection of evolution.

Religious predictors of rejection of evolution

There are several different ways in which religion might be related to whether or not churchgoers accept or reject evolution. The first relates to the nature of the church to which they affiliate. In the US, members of white, conservative, Protestant churches tend to be more likely to reject evolution than members of mainline churches (Baker 2013), though even in mainline Protestant and Roman Catholic churches there may be considerable support for teaching Creationism alongside evolution in schools, and rejection of the idea that humans evolved from other species (Berkman and Plutzer 2010). In the UK, rejection of evolution is more frequent among evangelicals and Pentecostals than among mainline Protestant denominations such as Anglicans or Methodists (Village and Baker 2013b). In the Netherlands, students attending orthodox (conservative) Protestant schools were much more

likely to express Creationist worldviews than those attending Roman Catholic or other schools (Schilders et al. 2009). These associations between affiliation and belief might arise because people are socialized into certain beliefs by their family or their church (Evans 2001; Müller et al. 2014). There is some evidence that social networks can moderate religious influences on beliefs about evolution among college students in the US (Hill 2014). Alternatively, associations between affiliation and belief might arise if people who reject or accept evolution are drawn to join particular kinds of churches. In cross sectional studies it is difficult to separate these different possibilities because the outcome looks similar in each case: the proportion of people rejecting evolution is higher in conservative Protestant churches than in others.

A second way in which religion might relate to rejection of evolution is through individuals' general theological stance. Theological conservatism is associated with rejection of evolution, and is also linked to belonging to certain denominations. However, it might be that within all denominations there is some variation between individuals in their level of conservatism, and this variation might be more important in shaping rejection than the particular denomination to which an individual belongs. In other words, it is individual belief, rather than denominational affiliation *per se*, that is the better predictor of whether or not Darwinian evolution is rejected or accepted. Individuals who express the same level of theological conservatism might display similar levels of rejection, irrespective of the tradition of the church to which they belong. In the UK, theological conservatism is associated with a range of different denominations, and can manifest itself in various ways. Among Anglicans, for example, theological conservatism is often associated with evangelicalism and with more literal and conservative beliefs about the Bible (Village 2005a, 2007), and this may be typical across most denominations.

A third way in which religion might relate to rejection of evolution is through measures of the salience of religion and the strength of attachment to a religious community. In a study of scientist's perception of conflict between religion and science, Ecklund and Park (2009) drew on Berger's notion of plausibility structures to posit that, since most scientists are irreligious, religious scientists who attend religious services more often would be less inclined to see science and religion as being in conflict. Religious practice, and especially spending time with others who can reinforce beliefs, may be a key way in which denominational affiliation is linked to individual beliefs. This idea that beliefs are reinforced by attending church has been shown in several studies in the US related to areas such as homosexuality and environmentalism (Burdette et al. 2005; Finlay and Walther 2003; Hand and Liere 1984). In some cases the effect of attendance was tradition-specific, leading to more conservative views among more frequent attendees of conservative churches but less effect, or more liberal views, among more frequent attendees of liberal churches. The same may be true of reading Scripture. Reading the Bible, alone or in groups, can reinforce a sense of identity with a particular tradition and the accepted norms of that tradition (Bielo 2009; Malley 2004; Rodman 2009; Ronald 2012). On this basis, those in conservative traditions who read frequently might be more likely to interpret in ways that promote rejection of evolution, but this may not necessarily be so in other traditions.

Education and rejection of evolution

Level of education might be associated with the likelihood of accepting or rejecting evolution for several reasons. First, it might betoken exposure to teaching about evolution which enables individuals to overcome modes of thinking such as essentialism, which tend to be at odds with Darwinian ideas (Evans 2001; Shtulman and Calabi 2012). However, among some educationalists there has been a great deal of concern about the apparent ineffectiveness of teaching science (and specifically biology) in schools, which challenges the underlying

assumption that better education in the subject will lead more acceptance of evolution (Antolin and Herbers 2001; Blancke et al. 2011; Cornish-Bowden and Cárdenas 2007; Mackenzie 2010; Williams 2009). Other studies have highlighted the fact that exposure to knowledge about evolution has relatively little effect on influencing views about evolution, especially among students who belong to certain religious traditions (Baker 2013; Blackwell et al. 2003; Hill 2014).

Second, level of education may indicate greater exposure to a range of different ideas and ways of thinking critically about them. In this case it is less about specific knowledge related to evolutionary theory, and more about the effects associated with education in Western liberal democracies. There is some evidence to show that general, rather than specifically scientific, education tends to decrease support for teaching Creationism in schools (Lac et al. 2010), but the effect is small, suggesting considerable variation among people with similar levels of education (Berkman and Plutzer 2010). This lack of effect of education on beliefs related to areas of science is part of a more widespread phenomenon that includes perceptions of risk (Kahan et al. 2011). One explanation draws on the Cultural Cognition thesis, which stresses the importance of shared values and group identities in influencing the way in which individuals interpret scientific information (Kahan 2015; Persson et al. 2015). Although it has its critics (van der Linden 2016), the theory has been applied to a study of the rejection of evolution in the US (Kahan and Stanovich 2016). The authors examined belief about evolution among two samples, one of undergraduates and the other a national sample, which completed a measure of general critical reasoning ability. The results suggested that high levels of critical reasoning were associated with increased acceptance of evolution among those with low religiosity, but *decreased* acceptance among those with high religiosity. This was interpreted to support the 'Expressive Rationality' theory whereby individuals use their cognitive resources to affirm beliefs that are central to

their religious identity. An unrelated study using Wave II of the Baylor Religion Survey found that acceptance of evolution was positively correlated with education level among those who believed the Bible to be an ancient book of history and legends, but negatively correlated among biblical literalists (Baker 2013). This suggests that the effect of education on beliefs about evolution may interact with denominational identity or particular theological commitments associated with that identity.

Research questions

Building on previous research from the UK and elsewhere, this study aims to test the following hypotheses among a sample of UK churchgoers. The first group of hypotheses relate to the effects of general or subject-specific education on rejection of evolution. Science or biology education might reduce rejection by increasing knowledge about evolution and natural selection, and theological education might reduce rejection if it indicates exposure to non-literal alternatives to interpreting the Bible. In each case, the effects of education may vary between those belonging to mainline rather than evangelical or Pentecostal churches.

H1: Rejection of evolution will be more likely among those with lower than higher levels of education

H2: For those with any given level of education, people with specifically science, biology or theology education will be less likely to reject evolution.

H3: Education will have more effect in promoting the acceptance of evolution among those from more liberal than from more conservative church traditions.

The second set of hypotheses relate to the effects of individual theological stance rather than church affiliation. Here, individual conservatism should predict greater probability of rejection over and above an individual's church tradition. A related question is whether any variations in the effect of education on beliefs about evolution can be explained solely by

denominational affiliation, or whether individual theological conservatism has explanatory power over and above affiliation.

H4: Individual theological conservatism explains rejection of evolution after allowing for tradition affiliation.

H5: Individual beliefs are more important than church tradition affiliation in explaining variation in the effectiveness of education in promoting acceptance of evolution.

The final set of hypotheses relate to the effects of church attendance and Bible reading frequency on rejection of evolution. These are both religious practices that may enhance the effects of religious belonging on maintaining specific religious beliefs (in this case related to evolution). Frequent practice may also reduce the influence of education on evolution belief because it is associated with increased identity with a particular denomination or religious tradition. Previous research suggests the possibility that the effects of closer belonging may depend on the group to which someone affiliates: frequent practice in a conservative setting may induce more conservative beliefs while frequent practice in a liberal setting may induce more liberal beliefs. In this case, frequent practice may increase rejection of evolution in Evangelical/Pentecostal churches but reduce it in Anglican/Methodist churches.

H6: More frequent church attendance and more frequent Bible reading are associated with greater likelihood of rejecting evolution.

H7: More frequent attendance and/or Bible reading reduce the effectiveness of education in promoting acceptance of evolution.

H8: The effects of attendance or Bible reading frequency on rejection of evolution are more pronounced among those from more conservative than those from more liberal church traditions.

Method

Sample

Following a 2009 survey about evolution and creationism among churchgoers in England (Village and Baker 2013b), a revised questionnaire, focusing more on creation and the environment, was distributed to a different set of churchgoers between 2015 and 2017. Questionnaires from both waves of the survey included similar items measuring rejection of evolution, church affiliation, church attendance, bible-reading frequency, education experience, and individual theological stance. In all there were 1328 returns in 2009 and a further 904 from different individuals in the follow up survey. There was no evidence of any systematic differences between the two surveys, so data were combined to give a total of 2232 records. Of these, 56.3 per cent were completed by women, 33.0 per cent were aged under 50, 44.9 per cent aged between 50 and 69, and 22.1 percent aged 70 or older (Table 1). Respondents were from over 200 different churches, mostly from northern England. This was a convenience sample of committed churchgoers from mainline and conservative Protestant denominations. The data do not indicate the frequency of rejecting evolution among the churchgoers in the UK generally, and they are used here to indicate the factors that predict belief about evolution in this particular sample.

Instruments

Rejection of evolution

Evolution needs to be defined carefully in surveys (McCain and Kampourakis 2016). For example, Creationists may accept ‘micro’ evolution within biblical ‘kinds’ (Morris and Parker 1982; Poling and Evans 2004), but not the evolution of simpler forms of life into more complex forms as proposed by Darwin’s ‘tree of life’. The question about evolution was therefore preceded by a statement clarifying what was intended by the term:

> Darwin and others proposed that all life evolved from simple organisms that gave rise to more complex forms of life through natural selection, a process which does not necessarily require God's intervention. The theory of evolution suggests that different kinds of animals such as reptiles, fish, birds and mammals all originated from a common ancestor. This has also been applied to human beings, who are thought to share a common ancestor with apes and monkeys.

This statement was followed by the question, "Do you accept the idea that all life evolved from simple creatures?" which had the following possible answers:

> No: I think this view of the origin of species is mostly wrong.
> Not sure: my beliefs on evolution are entirely uncertain or neutral.
> Yes: I think this view of the origin of species is mostly correct.

Answers were used to categorize the sample into those who definitely rejected evolution versus those who were not sure or accepted evolution.

Tradition affiliation

Respondents were asked to indicate their church's denominational affiliation, with eight possible options, and an open answer for 'other'. The main responses were Fellowship of Independent Evangelical Churches (28 per cent), Anglican (25 per cent), Baptist (16 per cent), Pentecostal (10 per cent), and Methodist (7 per cent). Initial analysis suggested little difference between the evangelical and Pentecostal respondents, so for the purpose of this study church tradition was measured as a dummy variable 'evangelical and Pentecostal', termed EP hereafter, (= 1) versus the rest (=0). The former group included Baptists and a few 'new churches', the latter included a few from the United Reformed Church and some Roman Catholics but were mainly Anglicans and Methodists (termed AM hereafter).

Education

The questionnaires included items that asked for highest educational qualifications in four categories: overall, any science (including mathematics), biology, and religion/theology. From this it was possible to separate out qualifications in non-biological science. Responses in each case were coded as ‘none’ (= 1), ‘school’ (= 2), ‘undergraduate’ (= 3), and ‘postgraduate’ (= 4) and treated as ordinal variables.

Theological stance

An item originally developed for use among Anglicans (Randall 2005) was used to measure the extent of theological liberalism versus conservatism. It was preceded by the question ‘Where would you locate your faith position?’, and respondents were invited to indicate on a seven-point semantic-differential scale anchored at ‘liberal’ and ‘conservative’. Responses were treated as continuous scales for the purposes of analysis, but categorized into three groups (using the two extreme scores at either end and middle three scores) to demonstrate interactive effects. The theological conservatism scale is correlated with conservative beliefs about the Bible, such as inerrancy and literalism (Village under review). In this study, a subsample of questionnaires contained items used to create a six-item scale measuring literal interpretation of Genesis (Village 2014), and this scale was positively correlated with the theological conservatism scale ($r = .48$, $df = 1516$, $p < .001$). The conservatism scale is used here because it was given to the whole sample and it assesses more than just biblical conservatism.

Religious practice

Church attendance was measured by the question ‘On average, how often do you attend a service in church?’ with a six-point response scale ranging from ‘a few times a year’ to ‘more than once a week’. Bible reading frequency (BRF) was measured by the question ‘How often do you normally read the Bible?’, with a seven–point response scale recoded into ‘rarely’

(=1), ‘monthly’ (=2), ‘weekly’ (=3), and ‘daily’ (=4). Both measures were treated as ordinal variables.

Analysis

Of the 2232 cases, 7.7% had at least one missing value in the variables used in this analysis (with no variable having more than 10 per cent missing), so multiple imputation (using the SPSS default of five imputations) was used to facilitate multiple regression on the full sample. Profile samples and contingency analyses are based on pooled values from this imputation. The dependent variable, rejection of evolution, was categorical so logistic multiple regression modeling was used to test the effects of predictor variables. A series of nested models were used to test specific hypotheses using main effect and interaction terms. Ordinal variables were centered on the most frequent category and continuous variables were grand mean centered. Significant interactions were displayed graphically by calculating estimated marginal means with 95% confidence intervals using the Generalized Linear Modelling procedure in SPSS 23

Results

Rejection of evolution was much more frequent among people from EP churches (82.6 per cent) than among those from AM churches (35.5 per cent, Table 1). Women formed the majority in both tradition groups, with a slightly higher proportion of women from AM than EP churches (59.6 per cent versus 54.7 per cent) churches. Respondents from EP churches were significantly younger, with 40 per cent aged less than 50 compared with fewer than 20 per cent in AM churches. In terms of education, those in AM churches showed slightly higher levels, on average, of overall and theological education to those from EP churches, but there was no difference in levels of science or biology education. Both groups showed high levels of church attendance (93.3 percent attending weekly or more) and Bible reading (68.3 percent

daily), though in both cases averages were higher in the EP group (Table 1). Average conservatism scores were higher among those from EP than AM churches (mean (SD): 5.40 (1.75) versus 4.22 (2.09) $p < .001$), confirming that the EP churches represented the more conservative tradition in this sample, though there was variation with each tradition. Across all denominations, rejection of evolution was similar among men and women, declined with age, declined with increasing levels of general, scientific and theological education (but not biological education), and was strongly positively associated with frequent church attendance and Bible reading, and with conservatism (Table 2).

Education and rejection of evolution

After controlling for sex, age and church tradition, education was a significant predictor of reduced likelihood of rejecting evolution (Table 3, Model 1), supporting Hypothesis 1. Respondents with post-graduate levels of education were half as likely to reject evolution compared to those with no formal education qualifications. Adding information on the specific type of education (not shown) made no difference to the model, though theology graduates were slightly less likely to reject evolution compared with those who had no formal theological qualifications. The main point was that higher levels of specifically scientific or biological education did not seem to promote acceptance of evolution over and above having exposure to graduate or (particularly) postgraduate education generally, rejecting Hypothesis 2. Adding an interaction term between overall education level and church tradition (Model 4) also made no significant difference to predicting rejection of evolution, rejecting Hypothesis 3. Higher education seemed to have some influence on the likelihood that these churchgoers would accept evolution, but the effect was relatively small compared with affiliation, and Anglicans and Methodists were no more or less affected, on average, by education than were evangelicals and Pentecostals.

Theological stance and rejection of evolution

Adding individual theological conservatism (Model 2) reduced the effect of church tradition somewhat (compared with Model 1) since evangelicals and Pentecostals were generally more conservative than were Anglicans and Methodists. Even with church tradition in the model, conservatism was associated with greater likelihood of rejecting evolution, supporting Hypothesis 4. Testing for interaction with education (Model 5) showed that individual self-reported conservatism, rather church tradition, helped to explain the differential effects of education. This supports Hypothesis 5, which posits that individual beliefs are more important than church affiliation in explaining variations in the effects of education on acceptance of evolution. The plot of marginal means (Figure 1) showed that, among those who rated themselves as most conservative, education had little or no effect in reducing rejection of evolution, whereas among other groups education was associated with reduced probability of rejecting evolution.

Religious practice and rejection of evolution

When church attendance and BRF were added (Model 3), both forms of practice were independently associated with a significantly increased likelihood of rejecting evolution, supporting Hypothesis 6. Interactions with education (Models 6 and 7) were not significant, suggesting that increased practice in the form of more frequent church attendance or Bible reading did not influence the effect of education in promoting the acceptance of evolution, rejecting Hypothesis 7. Interaction with church tradition indicated that Bible reading (Model 9), but not attendance (Model 8), had a differential effect between the two church tradition groups. However, the plot of marginal means (Figure 2) was not as expected from Hypothesis 8, which predicted reduced likelihood of rejecting evolution among more frequent readers in Anglican and Methodist churches and increased likelihood of rejection among more frequent readers in Evangelical and Pentecostal churches. In fact rejection increased with more frequent reading in both groups, and the interaction effect was because daily (rather than less

frequent) reading among AM churchgoers was associated with a greater increase in the probability of rejection compared with the same comparison in EP churchgoers. It seemed that frequent Bible reading is generally associated with greater rejection of evolution, implying that in this sample there were few avid Bible readers in Anglican/Methodist churches who accepted evolution.

Discussion

The results of this study confirm findings from elsewhere that show that rejection of evolution is a complex phenomenon that is not simply related to education experience or denominational affiliation. In this sample of UK churchgoers higher levels of education were partly related to a reduced likelihood of rejecting evolution, but the effect was weak and by no means a sufficient explanation. A large proportion of graduates and postgraduates in this sample rejected evolution, and those having specifically scientific, biological or theological education were little different from those with other sorts of degrees. This is in line with evidence from the US that suggests Creationist belief is not the prerogative of the ignorant, and is instead a belief often held by people who evidence (through their qualifications) high levels of rational and analytical thinking. What seems to drive rejection of evolution in this sample is a prior commitment to theological belief that respondents classed as more 'conservative' than 'liberal'. The content of this construct has been explored in more detail elsewhere among UK churchgoers (Randall 2005; Village under review), where conservatism is linked to range of doctrinal beliefs, moral attitudes and, crucially, beliefs about the Bible. It is probably conservative attachment to the authority and infallibility of inerrancy of Scripture that makes them suspicious of a system of evolution that seems counter to the Genesis accounts of creation and which seems to exclude any possibility of divine purpose shaping the unfolding of life on our planet. What makes a UK (rather than US) sample useful in this area is that evolution is unlikely to have been rejected because it is a shibboleth for wider

political ideologies (Berkman and Plutzer 2010; Eve and Harrold 1990; Freeman and Houston 2011; Moore 2000).

In this sample, respondents who identified themselves as more theologically liberal than conservative were more likely to show an effect of general education on rejection than those who identified themselves as more conservative than liberal (Figure 1). There was some indication that the same may be true for Anglican/Methodists versus Evangelical/Pentecostals, but this effect was not significant and it seemed that individual conservative belief, rather than denominational allegiance, may be a more direct influence in reducing the effect of education on acceptance of evolution. Church tradition remained an important influence even after allowing for individual theological stance, possibly because there are other aspects of belief and attitude that are associated with denominational affiliation but which were not assessed in this study. In a society where religious faith is increasingly a matter of personal choice rather than acquired habit, the power of congregations or denominational teaching to affect individual belief may be waning. This suggests there may be considerable variation in beliefs about evolution in some mainstream congregations, something that has been reported for parallel beliefs such as biblical literalism (Village 2005b, 2007). Denominational affiliation is a useful, easily assessed marker that can stand as a proxy for a range of theological beliefs and attitudes, including rejection of evolution. However, it may be an inadequate tool in helping us to advance understanding about why religious individuals have a particular stance on matters related to science and religion.

Clearly, interpretative practice and specific beliefs about creation or evolution must be acquired from somewhere, and this is where denominational teaching related to particular traditions may have a key role. The idea that biblical truth is always (or nearly always) ‘literal’ truth, and that the Bible is authoritative on all matters (including those related to

‘scientific’ matters) is associated particularly with some forms of evangelicalism, notably those that found expression in the Chicago statement on biblical inerrancy (Henry 1979; ICBI 1978). This statement makes specific reference to the Bible’s veracity in relation to creation:

> Being wholly and verbally God-given, Scripture is without error or fault in all its teaching, no less in what it states about God's acts in creation, about the events of world history, and about its own literary origins under God, than in its witness to God's saving grace in individual lives. (ICBI, 1978, short statement 4)

In the sample studied here, increased frequency of Bible reading was associated with increased likelihood of rejecting evolution, an effect which was particularly marked among Anglicans and Methodists who read the Bible daily. This sort of practice is associated with evangelical traditions within Anglicanism (Village 2007), and this may explain the association. Bible reading with particular assumptions about how it is interpreted may reinforce literal belief in the Genesis accounts of creation, and thereby increase suspicion about evolution.

Theological conservatives attribute greater authority to the Bible than do theological liberals, so they tend to read it more often and interpret it more literally. Creationists tend to be rationalists (Village and Baker 2013b) and therefore will assume that evidence for biblical creation events must exist, and should be accessible to science. What is disputed is not so much the evidence as how it is interpreted. The results here are in line with notions of cultural cognition and expressive rationality (Kahan and Stanovich 2016) insofar as there was a greater disparity in rejection probabilities among graduates than among those with no education qualifications (Figure 1). However, this seemed to be mainly because education allowed liberals to accept evolution more often, rather than because education allowed conservatives to reject evolution more often. Future studies could investigate further how science graduates who reject evolution view the nature and status of biblical authority compared with the authority science. Theological liberals interpret the Bible less literally, and

are more open to accepting the conventional scientific interpretation of the evidence. The difficulty for them is in finding intellectual ways of explaining how God can influence the destiny of creation in general and human beings in particular. For both groups, the underlying theological issue is how to reconcile conflicting world-views that on the one hand posit a God who exerts some sort of 'control' on the natural world and on the other hand a natural world that emerged and evolved without any 'exterior' interventions. Although educational experience might be of some use, the evidence here suggests that it does not do much to influence some prior theological beliefs.

In this sample acceptance of evolution was associated with relatively infrequent engagement with the Bible, suggesting that alternatives to literal interpretation that nonetheless maintain the authoritative priority of Scripture may be unusual. This might be a product of the sample if pro-evolution liberals were less interested in taking part in this sort of survey than were anti-evolution conservatives, though lack of engagement by liberals with Scripture has been noted elsewhere (Village 2007). It might be difficult to engage UK churchgoers who accept evolution (who may be the majority) with a survey on the subject if they feel it is generally irrelevant to their faith. This study was based on a reasonably large sample of churchgoers, but suffers from being a convenience sample that relied on volunteers who were sufficiently interested in the topic to take part. Future studies could investigate in more detail how those who generally accept evolution reconcile this with beliefs about biblical authority and interpretation.

Table 1 Sample profiles for Anglican/Methodist (AM) and Evangelical/Pentecostal (EP) respondents.

		Total	AM	EP			
	N =	2232	770	1462			
					χ^2	*df*	*p*
Reject evolution	Not reject	33.6	64.5	17.3			
	Reject	66.4	35.5	82.6	502.7	1	<.001
Sex	Male	43.7	40.3	45.3			
	Female	56.3	59.6	54.7	5.0	1	.028
Age	Under 50	33.0	18.8	40.4			
	50-69	44.9	47.8	43.3			
	70+	22.1	33.4	16.2	140.7	2	<.001
All education	None	12.1	10.0	13.1			
	School	28.9	26.4	30.2			
	UG	40.6	40.9	40.5			
	PG	18.4	22.7	16.1	18.6	3	<.001
Science without biology	None	20.9	19.6	21.5			
	School	52.0	51.9	52.1			
	UG	19.6	20.0	19.4			
	PG	7.5	8.5	7.0	2.3	3	.509
Biology	None	41.0	43.8	39.6			
	School	47.1	44.5	48.4			
	UG	9.0	8.4	9.3			
	PG	2.9	3.2	2.7	4.8	3	.191
Theology	None	53.4	52.9	53.8			
	School	34.6	32.5	35.7			
	UG	9.6	10.5	9.1			
	PG	2.4	4.2	1.4	18.4	3	<.001
Conservativism	Liberal	14.3	26.0	8.2			
	Neither	39.6	40.5	39.1			
	Conservative	46.1	33.5	52.7	151.8	2	<.001
Attendance	<weekly	6.7	11.6	4.1			
	weekly	44.9	56.2	38.9			
	>weekly	48.4	32.2	56.9	138.7	2	<.001
Bible reading	Rarely	5.9	13.3	2.1			
	Monthly	8.1	15.5	4.2			
	Weekly	17.7	21.9	15.5			
	Daily	68.3	49.3	78.2	261.0	3	<.001

Note. Chi-squared statistics test for differences between AM & EP church traditions, based on counts.

Table 2 Rejection of evolution among different groups

		N	% Not Reject	% Reject	χ^2	*df*	*p*
Sex	Male	974	33.9	66.1			
	Female	1258	33.5	66.5	0.0	1	.941
Age	Under 50	736	27.5	72.5			
	50-69	1002	31.6	68.4			
	70+	494	47.0	53.0	53.5	2	<.001
All education	None	269	27.7	72.3			
	School	645	27.7	72.3			
	UG	907	34.5	65.5			
	PG	411	45.0	55.0	38.7	3	<.001
Science without biology	None	466	31.0	69.0			
	School	1161	31.9	68.1			
	UG	437	37.3	62.7			
	PG	168	43.5	56.5	12.8	3	.005
Biology	None	916	35.2	64.8			
	School	1051	31.5	68.5			
	UG	201	35.3	64.7			
	PG	64	42.2	57.8	5.6	3	.133
Theology	None	1193	33.1	66.9			
	School	772	30.4	69.6			
	UG	214	43.9	56.1			
	PG	53	52.8	47.2	22.7	3	<.001
Conservativism	Liberal	320	64.6	35.4			
	Neither	883	39.9	60.1			
	Conservative	1029	18.7	81.3	255.7	2	<.001
Attendance	<weekly	150	65.3	34.7			
	weekly	1002	44.4	55.6			
	>weekly	1081	19.3	80.7	218.7	2	<.001
Bible reading	Rarely	132	87.0	13.0			
	Monthly	181	70.0	30.0			
	Weekly	396	45.6	54.4			
	Daily	1523	21.6	78.4	399.6	3	<.001

Note. Chi-squared statistics test for differences between rejection and non-rejection, based on counts.

Table 3 Logistic regression of rejection of evolution

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	0.54***	0.71***	1.03	1.21	1.27*	1.26*	1.26*	1.26*	1.39**
Female	0.91	0.73**	0.72**	0.71**	0.68**	0.70**	0.70**	0.70**	0.69**
Age	0.84*	0.82*	0.72***	0.71***	0.72***	0.72***	0.72***	0.72***	0.73***
Evangelical/Pentecostal (EP)	8.03***	6.42***	4.53***	4.99***	4.65***	4.65***	4.64***	4.71***	4.00***
Education	0.77***	0.74***	0.66***	0.57***	0.69***	0.65***	0.64***	0.65***	0.65***
Conservatism		1.50***	1.40***	1.40***	1.49***	1.40***	1.41***	1.40***	1.41***
Church attendance			1.66***	1.54***	1.50***	1.57***	1.54***	1.41**	1.54***
Bible Reading Frequency (BRF)			2.01***	2.03***	1.99***	2.01***	1.98***	2.02***	2.35***
EP x Education				1.27					
Conservatism x Education					1.19***				
Education x Attendance						1.05			
Education x BRF							0.97		
EP x Attendance								1.15	
EP x BRF									0.74*
Correctly identified (%)	76.6	78.0	80.4	80.6	80.8	80.6	80.6	80.7	80.9
Nagelkerke R^2	.29	.38	.46	.47	.47	.46	.46	.46	.47

Note: Table shows odds ratios. Numbers >1 indicate a greater probability of rejecting evolution,<1 a greater probability of being unsure or accepting evolution. Ordinal variables were centered on the most frequent categories, i.e. age: 50-69 years; education: undergraduate; BRF: daily. Conservatism and attendance were grand mean centered. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Figure 1. Probability of rejecting evolution in relation to education level by theological stance

Note. Theological stance is categorized as conservative (triangles), liberal (circles) and neither (squares). Points are estimated marginal means (± 95% CL). UG = Undergraduate; PG = Postgraduate.

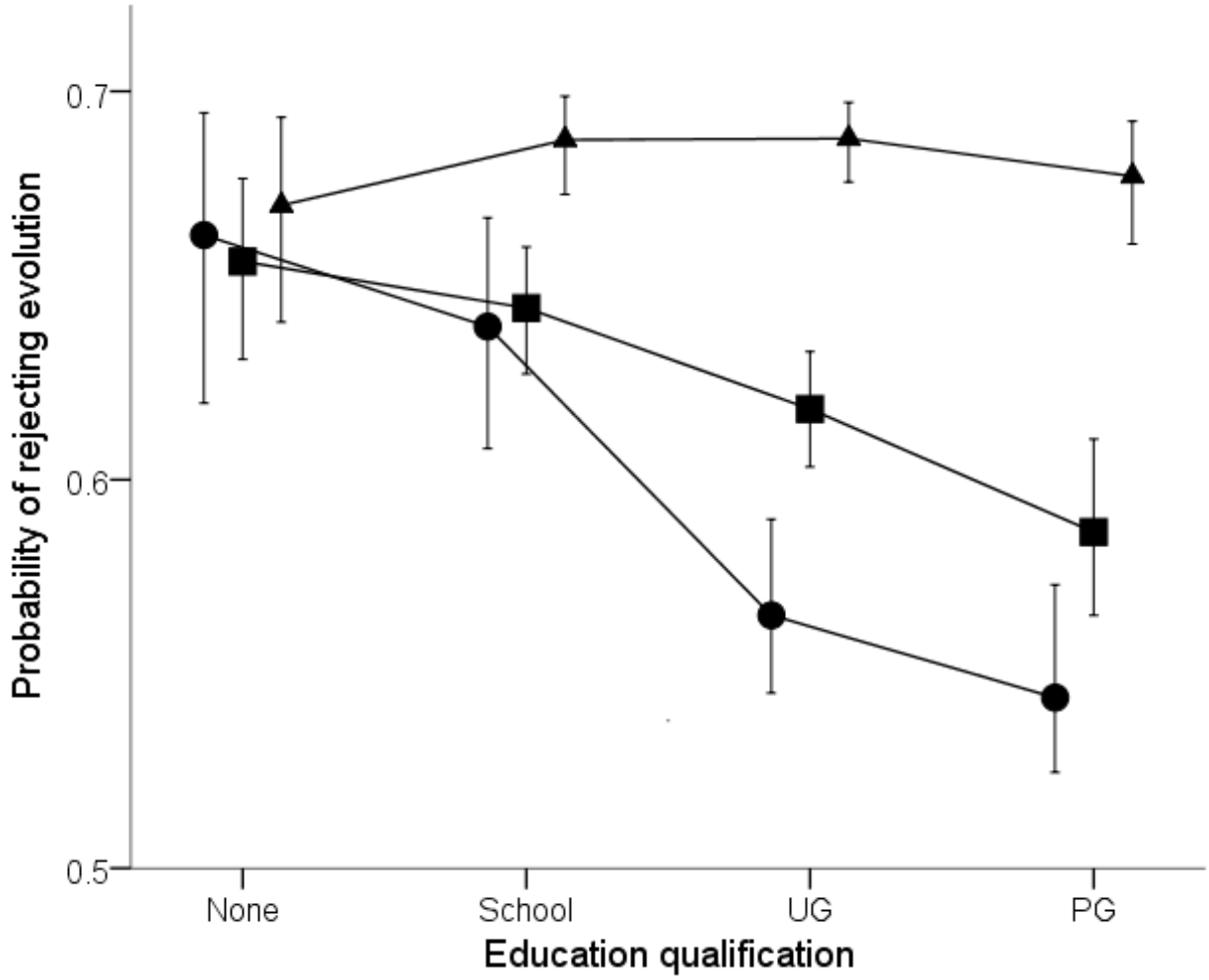
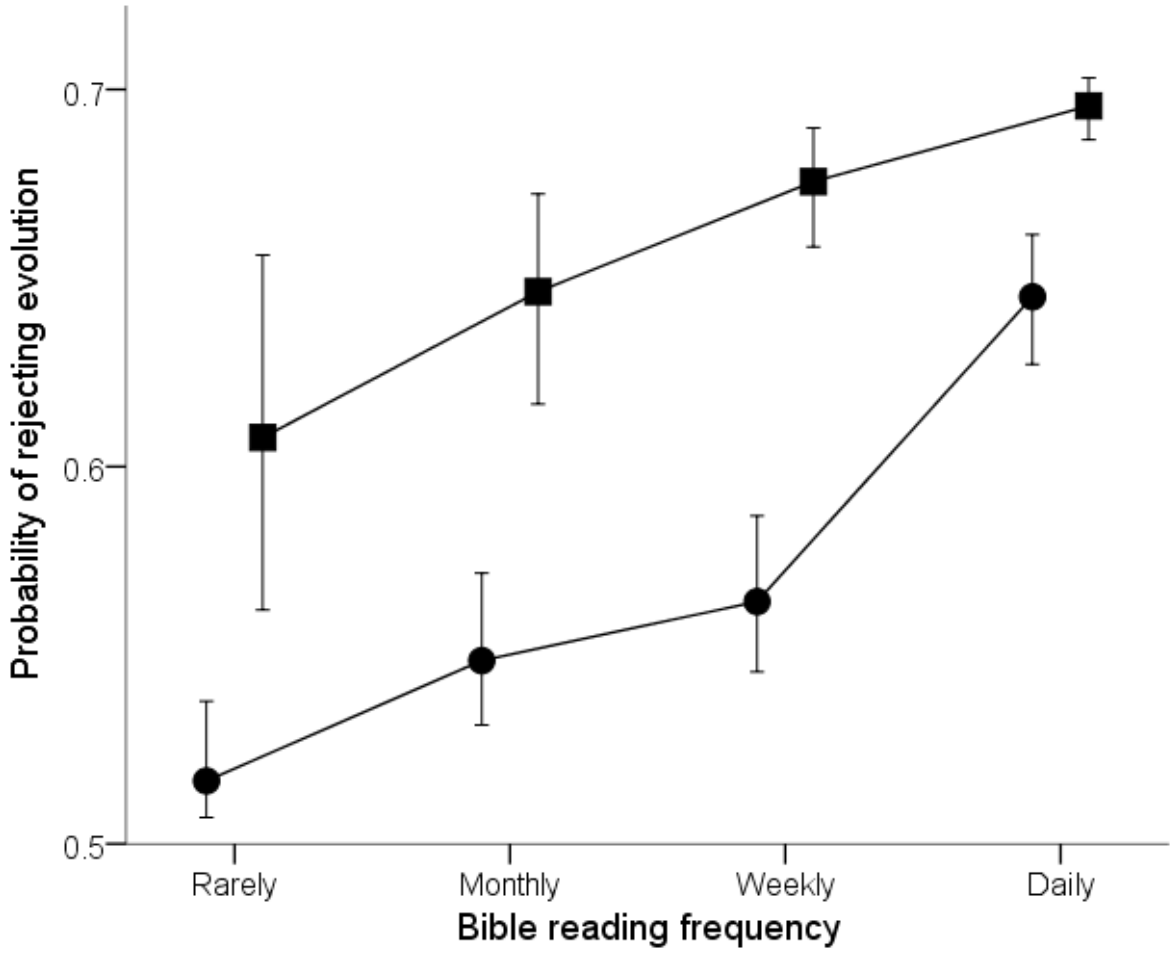


Figure 2. Probability of rejecting evolution in relation to Bible reading frequency by church tradition affiliation.

Note. Church tradition is categorized as Anglican/Methodist (circles) and Evangelical/Pentecostal (squares). Points are estimated marginal means (± 95% CL).



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