Technology in Society 38 (2014) 48–59

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

The impact of religious faith on attitudes to environmental issues and Carbon Capture and Storage (CCS) technologies: A mixed methods study

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ARTICLE INFO

Article history:
Received 16 December 2012
Received in revised form 13 February 2014
Accepted 17 February 2014

Keywords:
Religion
Environmental values
Carbon Capture and Storage
Climate change
Risk

ABSTRACT

An exploratory mixed methods study was conducted to investigate potential differences in the pro-environmental values and beliefs of people from the UK Christian, Muslim and secular (non-religious) communities. The study explored how religion might shape perspectives on themes within the New Ecological Paradigm (NEP) scale, including the relationship between humans and the environment (Dunlap, Kent, Mertig, & Jones, 2000). This study also explored how religious beliefs and values might influence perspectives on: (a) climate change; and (b) the acceptability of Carbon Capture and Storage (CCS) technologies. Muslim and Christian participants' opinions about climate change and CCS technologies were shaped by the importance of environmental stewardship and intergenerational justice. Both groups had relatively low perceptions of urgency for environmental issues, particularly climate change, due to beliefs in an afterlife and divine intervention. Acceptance of CCS for Muslim participants was considered problematic due to teachings on stewardship, harmony values and the intrinsic value of nature. CCS was considered less problematic for Christian participants, who demonstrated anthropocentric values and evaluated environmental issues and technological solutions in relation to the extent to which they supported human welfare. Secular participants expressed anxiety in relation to environmental issues, especially climate change. Lack of belief in an afterlife or divine intervention led secular participants to focus on human responsibility and the need for action, bolstering the perceived necessity of a range of technologies including CCS.

1. Introduction

1.1. Research context: climate change and Carbon Capture and Storage in the UK

Climate change arguably presents the biggest peril to humanity this century [1]. National and regional governments worldwide are under increasing pressure to reduce emissions of greenhouse gases (GHGs). The UK national government is no exception, having committed to reducing GHG emissions by 80% by 2050 (compared to 1990 levels). Electricity generation is a prominent source of GHG emissions – a status that has prompted efforts to decarbonise this sector [2]. This is being achieved in a number of ways, one of which is the development of technologies, such as Carbon Capture and Storage (CCS), to reduce emissions from fossil-fuel burning plants and other carbon-intensive industries (e.g., steel manufacture). The UK government sees CCS as one of the most cost effective ways to achieve the decarbonisation of the UK's power sector and has demonstrated its commitment to CCS commercialisation by investing over £2bn in CCS research and development to date [3,4].

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http://dx.doi.org/10.1016/j.techsoc.2014.02.003

However, public opinion concerning technologies like CCS will affect the speed and ease with which projects are permitted and constructed, and the scale and likelihood of investment from governments and other investors [5–7]. Well known examples of poorly received technologies (e.g., nuclear power stations, wind farms and more recently hydraulic fracturing or 'fracking') illustrate how public acceptance or rejection of technologies can facilitate or inhibit their deployment [5]. In short, there is a pressing need to understand more about the factors that influence people's responses to environmental threats (e.g., climate change) and technological solutions, like CCS.

A number of factors are known to influence people's perceptions of new technologies: e.g., proximity to and familiarity with the technology, and attitudes, beliefs and values [8–11]. Values, for example, act as relatively stable guiding principles that enable individuals to evaluate situations, end states, or modes of conduct in terms of desirability [12] and so could promote acceptance or rejection of contentious or potentially risky processes like CCS. Sjöberg (2000) [10], for example, found that, with regard to nuclear power, moral considerations including concerns about the potential for the technology to "interfere" with nature were significant in guiding participants judgements of risk.

Bearing in mind the noted importance of values in predicting perceptions of new technologies, we argue that the influence of religion could be influential in the acceptance of CCS, which would see the long-term geologic storage of waste CO_2.

There are sizable religious communities in the UK, with the 2011 census revealing that 33.2 million (59.3%) of the usual resident population identified themselves as Christians and 2.7 million (4.8%) of the usual resident population identified themselves as Muslims, making these the most well represented religious faiths in the England and Wales [13]. Belief in world religions such as Christianity and Islam may be expected to differentially impact upon a person's perceptions of environmental issues and the proposed solutions, particularly if these solutions, like CCS, will necessitate the perceived "interference" with nature. In short, it could be postulated that individuals who believe in religions that favour the rights of humans to dominate the earth (e.g., Christianity) may be more accepting of the capture and storage of CO_2 in natural geological formations than those subscribing to religions that teach the importance of being in balance and harmony with nature (e.g., Islam).

1.2. Conceptual foundation: faith groups and attitudes to environmental issues

1.2.1. Western Christianity

Christian values towards the environment are diverse. Different traditions, for example, emphasise different aspects of the creation narratives. White's (1967) seminary work in this area focused on branches of the church that emphasise texts such as Genesis 1:26–28 [14]. This states that humans were given a divine edict to have dominion over the earth and increase in number [14]. However, other traditions, especially among liberal and Protestant denominations, teach divinely sanctioned stewardship (e.g., Genesis 2:7–15) where humans are put in Eden to care for and till the earth [15–18].[2] To add further complexity, some contemporary movements focus on apocalyptic rather than creation narratives [16]. Apocalyptic beliefs are widely reported in American fundamentalist and Pentecostalist movements. Guth et al. (1995) express concern that the outlook of these churches risks their members becoming disengaged from current environmental concerns as they focus on preparing for the afterlife [16]. Fundamentalist Christian faith may even encourage individuals to welcome growing environmental problems as positive signs of the Second Coming. In support of this assertion, a recent US study found that American citizens most dismissive of climate change were more likely to be Evangelical Christians demonstrating a high level of religious observance [19]. This group was found to oppose international treaties to address climate change, only supporting low cost environmental policies.

In contrast American citizens' claiming to be most alarmed by climate change and expressing the strongest intentions to adopt more sustainable behaviours and support pro-environmental policies including cleaner energy generation, were more likely to describe themselves as non-religious, atheist or agnostic and to have low attendance rates at religious services [19]. This builds on previous studies which found that secularists are more likely to support environmental spending and regulation; and perhaps indicates that individuals who do not subscribe to Christian mastery values and eschatological beliefs are more likely to engage with environmental and political issues [15,20].

Nonetheless, Western Christianity, especially outside America, has demonstrated pro-environmental trends [15]. Harmony values and a stewardship ethic are visible within the modern Western church. The Anglican Church, for example, includes a declaration in The Five Marks of Mission concerning the safeguarding of ecological integrity and the sustenance and renewal of the earth [21]. A wide range of initiatives focussing on involving local congregations can also be seen including the Church of England's "Shrinking the Footprint" campaign which is aimed at reducing CO_2 emissions and the Catholic Church's "Live Simply" programme [22].

1.2.2. Islam

Islam has philosophical, ethical and theological overlaps with environmentalism, stewardship and harmony values, leading Whitford and Wong (2009) to hypothesise that Muslim communities will be associated with greater environmentalism than Christian communities [23]. The Qur'an does not have a word for the environment but speaks about "signs" of Allah – linking creation with divine revelation and seeing the environment as testimony to Allah's all-encompassing presence [24,25]. The Qur'an (55:1–9) teaches Muslims that the natural order was set in place by Allah, with all life-forms having a divinely appointed role in submission to His will. This has resulted in the concept of divinely ordained "balance" in nature with all things having their place. The Qur'an teaches that humans were given the responsibility to act as custodians

[2] For Bible quotations and references, see Holy Bible: New Revised Standard Version (NRSV).

of creation [25]. Islam has also been seen to promote reverence for all forms of life, including the fair treatment of non-human species. Religious literature, especially the Hadith, contains an abundance of traditions on this theme. The emphasis in Islamic teaching is on living in harmony and in "balance" with creation and with Allah who is all-encompassing. Ownership of the environment remains strictly in Allah's domain, with humans being held accountable for their treatment of divine property [24].

Within the UK environmental campaigns and movements can be found among Islamic adherents [26]. Examples of Islamic projects include: The Muslim Khatri Association and The Islamic Foundation for Ecology and Environmental Sciences (IFEES), which co-produced the Muslim Green Guide to Reducing Climate Change [26,27]. The Green Guide provides advice on living in a more sustainable way including how to reduce transport emissions and save energy in the home.

1.3. Research aims

The first aim of this study was to explore potential differences between the Muslim, Christian and secular participants in terms of pro-environmental values and beliefs to see how religion might shape perspectives on themes raised in the NEP scale. The NEP is a validated method for assessing people's general attitudes to environmental issues and assessing, more generally, the extent to which people hold eco-centric (nature-centred) or anthropocentric (human-centred) values (see Dunlap et al., 2000) [28]. The NEP contains items relating to five broad concepts or themes: (1) Anti-anthropocentrism; (2) The reality of limits to growth; (3) The rejection of exemptionalism; (4) The possibility of eco-crisis; and (5) The fragility of nature's balance; and has been used in numerous surveys in both religious and secular communities [28–31].

Secondly, the study aimed to explore how attitudes to CCS and climate change were shaped by religious beliefs. CCS has received substantial government investment in the UK and is seen as an important technology in reducing carbon emissions from power generation and other industry. However, as an unfamiliar technology option that could potentially be seen to prolong fossil fuel dependency (e.g., Wallquist, Visschers, Dohle, & Siegrist, 2011) and one that involves the long-term geologic storage of captured CCS (i.e. could potentially be viewed as interfering with nature), it was believed that the groups could have different perspectives on the acceptability of CCS as a way of mitigating CO_2 emissions from UK industry [32].

2. Methods

This research used a mixed methods approach combining in depth focus group discussions (based on topics from the NEP scale, see Dunlap et al., 2000) with a short questionnaire incorporating the full NEP scale [28].

Of these methods, focus groups were the predominant means of data collection. Focus groups were selected as they provide an appropriate forum for discovery-driven inquiry and good means of exploring controversial, unfamiliar and/or complex issues; helping to establish 'why' people feel the way they do about such issues and to learn more about how such issues are represented and become socially shared [33,34]. In this study, the focus groups provided a deliberative context in which the participants could consider and discuss the NEP topics and CCS in depth, while simultaneously allowing them to make reference to their main scriptural teachings. The follow-up survey was used to collect basic demographic data and included the full NEP scale which was used for indicative purposes (i.e. to provide a sense of potential differences between groups in terms of ecological worldview).

2.1. Participants

Muslim, Christian and secular participants were selected because members of these groups form a significant proportion of the usual UK resident population [13].

Focus group participants were principally recruited from The University of Sheffield Students' Union secular and religious student communities. Participants were contacted during January 2012 via their society email addresses, the Multi-faith Chaplaincy, the Muslim Welfare House and related social-networking websites.[3] Participation was incentivised through a £30 ($50 approx.) payment to the secular and religious societies that the participants represented. A total of four Protestant Christians (*Christian*), 10 Sunni Muslims (*Muslim*) and six secular students (*Secular*) agreed to take part in the study. Of the 18 participants who provided demographic details, 15 stated that they were educated to degree level or above and all stated that they were British with the exception of five Muslim participants and one Christian participant. The average age of participants was 26 years (range: 18–51 years). Further details of the focus group participants can be seen in Table 1.

A purposeful sampling strategy was employed to select participants. Purposeful sampling is a qualitative method where the researcher selects a small number of participants on the basis of their special attributes and ability to inform an understanding of the research question [35,36].[4] In this case participants were selected on the basis of their cultural heritage and religious beliefs.

Single-faith focus groups were held with the participants. This was done out of consideration for the comfort and convenience of the participants. Both Muslim and

[3] The Multi Faith Chaplaincy is part of The University of Sheffield and caters for the needs of students from a number of different faith traditions including Christianity and Islam. The Muslim Welfare House is an extension of The University of Sheffield's chaplaincy services, offering a place for prayer on campus.

[4] A sample size large enough to be statistically significant would have undermined the rationale for the use of qualitative methods by generating so much data that the inter-relationships between the observed factors and processes would not have been interpretable [36]. The intent of qualitative research is not to provide generalisable information, but rather to elucidate specific areas of interest to the researcher [35]. Rather than having statistically generalisable findings qualitative studies tend to have 'transferable' findings; that is findings which can be applied to certain contexts beyond the immediate location of the study where similar people, situations or phenomenon exist [37]. In qualitative research the 'generalizability' or 'transferability' of results is best described as theoretical rather than statistical [37].

Table 1
Details of the focus groups including faith, gender, mean age and mean NEP score.

Group	Faith	*N*	Gender[a] (M:F)	Mean age[a] (SD)	Mean NEP score[b] (SD)
1	Muslim	10	6:2	28.9 years (12.52)	3.36 (0.24)
2	Christian	4	3:1	26.3 years (5.56)	3.22 (0.37)
3	Secular	6	5:1	23.3 years (2.16)	4.05 (0.43)

[a] Two Muslim participants did not complete survey and so do not contribute to the mean age scores.
[b] Means calculated for participants who completed all NEP items only: Muslim ($N = 6$); Christian ($N = 3$); Secular ($N = 5$). Coded so higher scores mean more pro-environmental attitudes (scale mid-point = 3.00).

Christian participants met in their respective places of prayer immediately after the act of worship, while secular students recruited from a university society met elsewhere on campus. Keeping the groups separate helped to minimise the potential for conflict, broadening the opportunity for participants from each group to discuss interpretations of influential texts including sacred scriptures. This separation also enabled the researcher to focus fully on each group in turn and to maintain recommended focus group numbers of around 10 participants [38].

2.2. Focus group procedure

The focus groups took place at The University of Sheffield, UK. Each session lasted approximately 120 min. The researcher began the session by giving a brief presentation and overview of the research aims and the structure of the session. To help participants feel comfortable the session started with participants introducing themselves and discussing the texts that they had selected to share with the group. Discussion focused on the broader values and teachings that guide each group or religion, rather than on the personal beliefs of the participants. As such, participants in each discussion group were asked to comment on what their religion/group teaches followers about each of the factors and to cite relevant scripture and/or texts where appropriate.

The sessions were semi-structured, with discussion topics being based on the five principal factors assessed by the New Ecological Paradigm (NEP) scale (details outlined below and in Table 2); with CCS added as an additional topic of study [28]. In accordance with focus group guidelines from Descombe (2003), where questions related to CCS or other complex subjects, participants were provided with a short non-technical explanation [39]. During the focus group discussions, the researcher summarised the debate to clarify understanding of the participants' views on each subject and observational and reflexive notes were made [36]. At the conclusion of the focus groups participants were requested to provide basic demographic data including age, gender and religion. They were also requested to complete the revised NEP items in the form of a questionnaire [28]. Following this, participants were debriefed, thanked and dismissed.

The focus group discussions were recorded and transcribed and the transcript data was annotated and coded. Because themes had been set out in advance using the NEP,

Table 2
Focus group discussion topics.

NEP theme[a]	Statements used in focus groups (adapted from NEP items)
Anti-anthropocentrism	• What kind of person do you think would make the claim that *"humanity has a right to rule over nature"*? • Do you think *"humans have the right to modify the natural environment to suit their needs"*?
Limits of growth	• *"Limits to growth for human society exist"*. What do you think? • Do you think that *"we are approaching the limit of the number of people the earth can support"*?
Rejection of exemptionalism	• *"Humans – unlike other species – are exempt from the constraints of nature"*. Do you agree? • Do you think that *"humans will learn enough about how nature works to control it"*?
The possibility of eco-crisis	• Do you think that *"humans are severely abusing the environment"*? • Some people say that *"if things continue on their present course, we will soon experience a major ecological catastrophe"*. What do you think? • What kind of person would say that we are heading for a *"major ecological catastrophe"*?
The fragility of nature's balance	• Do you think that *"humanity has the ability to upset the 'balance of nature'"*? • Do you think that *"the balance of nature is strong enough to cope with the impacts of modern industrialised nations"*?
Carbon Capture and Storage (CCS)	• In light of our discussion so far, what are your initial thoughts and perceptions of Carbon Capture and Storage? • Do you feel that there are any ethical or moral implications that should be taken into consideration in the use of this technology?

[a] Pro-environmental attitudes are indicated by agreement with statements concerning the reality of limits to growth, that humans are abusing the environment and that there is a risk of eco-crisis and unbalance. Pro-environmental attitudes are also indicated by disagreement with statements about humans having the right to modify the environment, human exemptionalism and with the ability of nature to cope with the impacts of industrialised nations.

Template Analysis was later employed to code and analyse the resulting transcript data [40]. A number of subthemes were later identified and added to the coding manual [41]. Transcripts were analysed by an independent second coder using this coding manual. Inter-coder agreement was reached following discussion of each researcher's independent interpretations of the transcripts and the themes were then finalised [38]. To validate the results data from the transcripts was triangulated with the NEP items and literature findings [36]. The key themes raised in response to the six core issues are discussed below. Out of respect for participant confidentiality, all responses were anonymised meaning the real names of individuals are not provided here.

3. Results

The results from the NEP scale items given to participants as a questionnaire are presented below and followed by qualitative focus group data.

3.1. NEP scores

A one-way ANOVA with post-hoc (LSD) comparisons was conducted to compare mean NEP Scores in the religious and non-religious groups (see Table 1). There was a significant difference in the NEP scores between the groups, $F(2, 11) = 7.63$, $p = .008$. The mean score for the secular participants was significantly higher than both the Muslim ($p = .006$) and Christian ($p = .007$) groups. The mean NEP scores for the Muslim and Christian groups were comparable ($p = .594$).[5] Thus, while all three groups held generally pro-environmental attitudes, these were more pronounced in the secular rather than the religious groups.

3.2. Anthropocentric or ecocentric values

While religion influenced the participants' perceptions about the relationship between humans and the environment, all three groups spoke about human "responsibility" for environmental protection. The Christian and Muslim participants framed their response in terms of their theocentric beliefs, with humans having the God-given role as "guardians", with responsibility to care for creation. Focus was placed on scriptures promoting harmony and stewardship. For example, Christian participants discussed Genesis 2 observing that guardianship was "…not quite a right to rule [but] a case of privileged position" where humans because of their knowledge had a "unique responsibility" to care for creation (Sarah). Similarly, the Muslim participants emphasised Chapter 2.26–28[6] in the Qur'an, explaining that: "…everyone has a responsibility for the gifts and the way that they are used" (Beena).

Secular participants had a contrasting worldview, seeing the relationship between humans and the environment primarily in evolutionary terms, and rejecting beliefs in divine creation. They strongly rejected the assertions of dominance over nature (as stated in the NEP discussion topics) seeing human-beings as animals that had "co-evolved" with other species and arguing that "rights" were not God-given but rather societal constructs:

> *"[W]e have to modify the environment in order to live but it's not a 'right' […] we are animals like everything else."*
>
> *Andrew, Secular.*

Nonetheless, they agreed that humans as animals were distinct because of the capacity for reason and technological development which was endangering other species.

All three groups understood humans to have a special duty of care for the environment because of this capacity for reason and emphasised "responsibility" above "rights" over the environment and natural resources. Nonetheless, despite this shared language, motivations for environmental care were clearly different. For the Muslim participants their duties were embodied as a written ethical code in the Qur'an. They spoke in terms of unity and responsibility principles stemming from scripture:

> *"[E]verything we do is in relationship with other humans and animals … we are all connected and have an impact on one-another."*
>
> *Aabish, Muslim.*

The guidance laid out in the Qur'an reminded Muslim participants that they would be held accountable for their use of the environment, not only because it was a "sign" of Allah, but also, because it was ultimately divine property. Participants claimed that accountability to an all-seeing deity acted as a motivating factor for good environmental practices such as energy saving, regardless of whether these actions would be observed by others:

> *"It goes back to the fact our Lord is always watching […] you have that responsibility and you will be asked about it."*
>
> *Aabish, Muslim.*

Concepts such as "respect" for all life, "harmony" with nature and moderate use of the earth's resources arose throughout the Muslim focus group.

The Christian participants had a slightly different emphasis to both secular and Muslim participants. For them, environmental issues were important primarily because they were typically symptomatic of broader social issues. For these participants environmental stewardship could be summed up in the commandment to "Love Thy Neighbour" (Leviticus 19:18, Luke 10:27), portraying a far more anthropocentric stance to environmental protection. Indeed, environmental quality was seen as important because of its relationship with human welfare.

The holistic stance of the secular group was closer to that of the Muslim participants, seeing humans as an integral part of nature. The secular group took their precedent for human responsibility from the fact that humans could choose to regulate their behaviour. They argued that alteration of natural systems was acceptable if done with a thorough understanding of ecosystems in order to limit damage.

3.3. Limits to growth

The subjects of population growth and family planning resulted in a clear divide between religious and secular participants and also created some tensions. In Christianity and Islam families, and in particular larger numbers of children, are traditionally considered a blessing. This was clearly reflected in comments from both Christian and Muslim participants:

> *"[T]he Bible encourages population and family growth."*
>
> *Susan, Christian.*

[5] Values are calculated on the basis of those completing all NEP items. When reassessed using mean substitution for missing values, the same pattern in the results emerged: $F(2, 15) = 6.54$, $p = .009$ (Secular > Muslim, $p = .007$; Secular > Christian, $p = .008$; Muslim = Christian, $p = .631$).

[6] Quran 2:26 reads: "But seek, with the (wealth) which Allah has bestowed on thee, the Home of the Hereafter, nor forget thy portion in this world: but do thou good, as Allah has been good to thee, and seek not (occasions for) mischief in the land: for Allah loves not those who do mischief" [42].

"God created us to have offspring and spread our religion."

Beena, Muslim.

However, this belief created tensions because it was apparent to the religious participants that population size and resource issues were problematic. A variety of responses emerged. For some Muslim participants there was no perceived risk from the need to provide for a growing global population. They believed that these births were predestined and that God would meet human needs. This argument was most clearly expressed by Henna, who explained that:

"Everything that happens is written thousands of years ago by God […] I don't know what the future holds but God does and He is in control of the size of society and who lives and dies and when."

Henna, Muslim.

Another member returned to the theme of human responsibility arguing that while God would provide, He had given humans the capacity for reason, which they should use to act accountably:

"Islam also teaches that you should use your mind […] you can't have a lot of children and just trust in God and do whatever you want … you've got to live within your situation."

Sami, Muslim.

This indicates a practical theological stance: humans must do all they can using what they have been given and trust in God for the rest. Interestingly, this attitude seemed to make a difference to perceptions of environmental risk. For religious participants there was an assurance that after they had done their best, they could rely on God to address the issues beyond their control.

The absence of belief in a benevolent deity gave the secular discussion a far greater sense of urgency, which was reflected in their language. While the religious participants spoke about predestination, divine intervention and redemption at the end of time; secular participants focused on human self-regulation – repeatedly discussing possible timeframes for various environmental risks. The language used by the secular participants' added emphasis to the perceived urgency of the situation. Words such as "collapse", "crash" and "peak" frequently arose in addition to dates and timescales for action. For secular participants, humans were solely responsible for their own fate and emphasis was placed on the need for immediate action.

While three distinct positions on the issue of population emerged, it was evident that all the participants believed that unfair resource distribution was a fundamental limiting factor in human population growth. The debate was most clearly expressed by a secular participant who commented that:

"[I]t's not necessarily that we have too many people … it's how they live. There will be a point when we reach a limit, but 9 billion may not be it. I think the point is we are all living like kings and we shouldn't be."

Jonathan, Secular.

The religious participants did not see the issue of potentially reaching the number of people the earth could support as urgent; with the Christian participants arguing that the population would stabilise after all countries had fully developed. For Muslim participants, there remained a strong belief that for situations beyond their control, God would intervene: "[I]f God thought that, He'd sort it out" (Beena). In contrast the secular participants spoke of "huge consequences within our lifetime" (Jonathan).

3.4. Anti-exemptionalism

All three groups agreed that humans were not exempt from the constraints of nature — but again risk perception and beliefs about environmental issues appeared to be influenced by religion.

The Theocentric beliefs held by the Muslim group were expressed, with group members emphasising that humans were only a small and weak part of creation. The group spoke about human dependency on eco-system services observing that:

"[W]e are so dependent on God's creation … we have understood that we cannot survive without the plants and we have understood the fact that if we damage the ozone layer the sun will hurt us…"

Sami, Muslim.

Muslim participants also drew attention to the necessity of environmental conservation and development "without impinging on nature" (Azlan). The importance of knowledge for the "common good" was emphasised and it was acknowledged that disrespecting the environment would have "catastrophical consequences" (Azlan).

For the secular participants the conversation once more centred on the concepts of "co-evolution", the necessity for self-regulation and the adverse consequences of controlling nature:

"I think we can control it to the point where it completely falls apart […] with the amount of inputs we can put on the land to increase yields … but we forget that this is destroying the rainforests and streams and oceans … and what we could decide [is] to value them as having an intrinsic worth in themselves…"

Jonathan, Secular.

For the secular participants the relationship between humans and other species was an evolutionary one. Self-governance and correct values and understanding of human nature were open for debate because there was the belief that these were cultural constructs rather than God given rules and regulations. Control and manipulation of the environment was therefore seen most negatively by secular and Muslim participants.

For the Christian group controlling nature was seen in a more positive light than in the other groups: "Nature evolves … diseases evolve and we have to keep coming up with new solutions" (Susan). The discussion of Christian participants centred around disease, death and natural disasters, all of which were given as examples of nature having detrimental

effects on human life. Modifying the environment and exerting control were therefore perceived as largely beneficial.

One Christian participant talked about the negative or ambivalent views of the environment which had been held by the early church but argued that the church had: "[R] ejected this and affirmed God as creator and that creation was good" (Joshua). However, from the discussion it became evident that some churches still viewed life on earth as a time of trial. To some extent the concept of trial was also reflected in the debate among Christian participants in this study as they focused on the idea of God's Kingdom being present on earth but not yet here fully:

> *"The kingdom is present but not yet … the kingdom is coming and here but not quite yet and we are partners with God in trying to redeem creation".*
>
> *Joshua, Christian.*

This led to the idea of the present time being one of transition characterised by suffering and disturbance. The concept of the coming kingdom also influenced the time frame in which the group thought about risks making it very different to that of the secular participants:

> *"God's Kingdom is also here on earth to some extent … not fully because there is still suffering … we are part of nature and not exempt, but we have promise and hope of eternal life where nature will be slightly different."*
>
> *Susan, Christian.*

Whereas the Muslim and secular discussions were characterised by the themes of harmony, conservation and co-existence, the Christian group focused on transition and disturbance.

3.5. Eco-crisis

The concept of eco-crisis caused heated debate on a number of issues including: the role of technology in shielding humans from possible detrimental environmental impacts, the risk of extinction (including humans), and the role of values in deciding what to conserve. The existence and possible imminence of climate change was also discussed.

Christian participants advised caution in interpreting the Bible, and in particular apocalyptic scriptures, arguing that:

> *"[T]here is a danger of trying to quote mine the Bible … treating it like a crystal ball and looking for correlations … saying 'this is what is happening.'"*
>
> *Joshua, Christian.*

Instead they argued that broad biblical principles should be applied such as the concept of humans as co-creators with God, working to redeem nature (Romans 8). There was uncertainty and disagreement on the issue of climate change and the likelihood of possible detrimental effects within their lifetime:

> *"I think humans are abusing the environment […] whether we will experience a major catastrophe or not who knows?! […] It's hard to know what technology will become available in the future that would be more friendly to the environment."*
>
> *Susan, Christian.*

Some Christian participants felt uninformed and were concerned about misinformation, while others observed that there was significant academic consensus on climate change. However, the group emphasised that Christians did have a role to play in addressing environmental issues and argued that Christians should be at the "forefront of these things" (Susan).

The secular group held a range of opinions on the subject of eco-crisis. The discussion centred on values and whether human life and technological advancement were of greater value than eco-systems as they exist today. The predominant feeling was that other species would continue to exist but humans would risk extinction with rapid or severe climatic change. The range of possible consequences and uncertainty concerning time-frames are exemplified in this comment:

> *"If we are unable to work together to tackle climate change and grow crops without fossil fuels […] If we have peak oil in 30 years […] it is possible that we will miss the three degrees […] there will be droughts […] the ways we farm is based on very restricted climatic conditions."*
>
> *Jonathan, Secular.*

The group had consensus on the existence of climate change but disagreed on how soon its impacts would be felt. At points the discussion reflected that of the Muslim group because participants emphasised the interconnectedness of life on earth, observing that any environmental change would affect humans.

Muslim participants framed their response using the concepts of unity, respect and balance:

> *"…we have unbalanced the whole thing and we are part of that balance but we have created disequilibrium."*
>
> *Azlan, Muslim.*

Muslim participants commented that regardless of negative consequences on humans, damaging the environment was morally wrong. A number of international students in the Muslim group shaped the discussion on climate change. They spoke of unusual flooding events in North Africa, changed seasons in Algeria and altered rainfall patterns in Malaysia. While some participants were dubious that climate change had human causes, others, such as Azlan, argued that they had no doubt that:

> *"[W]hat the humans are doing is not helping … it might have natural things happening, but we are accelerating the speed."*
>
> *Azlan, Muslim.*

The group accepted that humans could cause large-scale environmental damage and that the consequences would be felt by all species. They referred to passages from the Qur'an, such as 28:77, regarding the potential of

humans to cause "mischief" on earth to give weight to this argument.

3.6. Balance

The discussion in all three groups centred on how resilient the environment was to industry and the rising demand for natural resources. One secular participant summarised the debate in the following way:

> *"Ultimately, you take the sum of all the earth's dynamic systems and they are much more capable of affecting us than we are on them; but we are still affecting them on a massive scale."*
>
> *Andrew, Secular.*

The secular group was dominated by PhD students from the sciences and this was reflected in the way that they addressed the subject of "balance". They spoke of the environment using terms such as "dynamic equilibrium", arguing that "ecological systems" constantly changed giving them "resilience" (Jonathan). Participants spoke about deforestation, impacts on water cycles, desertification, over grazing and plummeting fish stocks. There was consensus that humans could disrupt the ecosystems and that this was already occurring.

Muslim participants looked to the Qur'an for guidance on the issue of balance:

> *"I think if we hadn't the ability to upset the balance, the Qur'an and the Hadith wouldn't warn against the destruction […] to damage and cause destruction is to deny these blessings and this balance."*
>
> *Aabish, Muslim.*

For Muslim participants, humans were part of the balance of nature and environmental damage would result in negative effects on human wellbeing: "We have […] guidelines from Islam […] we are like a vicegerent … guardians" and "we should seek the common good" (Azlan and Labeeb). Responsible guardianship and sustainable lifestyles were also seen as matters of intra- and intergenerational justice:

> *"[W]e cannot say this is 'mine' […] there will be a new generation […] consumption is at an accelerated rate … selfishness, greed, arrogance … exploitation of poorer countries […] the idea is we should have individual and also national, regional – global responsibility."*
>
> *Azlan, Muslim.*

Muslim participants also saw damage to ecosystems as something which was already occurring:

> *"[I]ndustrialised nations have destroyed forests … polluted … evidence is already clear that the way we currently are — nature cannot cope."*
>
> *Sami, Muslim.*

The role of politics to solve these global issues and the need to reform agricultural practice and review supply chains and current trading practices were highlighted.

Christian participants also acknowledged that humans were having an impact on the environment. However, there was some uncertainty about the significance and consequences of human impacts on ecosystems. One participant argued that human impacts were small compared to the consequences arising from natural disasters such as volcanic eruptions. However, other Christian participants gave examples of species which humans had made extinct and commented on issues with consumerism and the exploitation of resources:

> *"[E]very other creature adapts, but our problem is we consume too much […] we could be upsetting the balance because we don't adapt […] In the New Testament there's the idea that there's only limited resources available […] there's condemnation of greed and desiring wealth to exploit other people and that applies to us today…"*
>
> *Joshua, Christian.*

In short, both the religious groups spoke in terms of resource consumption and religious teachings against greed; while in the secular group discussion of survival and extinction were most common.

3.7. Carbon Capture and Storage (CCS)

An important component of the research was the investigation of how religious faith might impact upon attitudes to CCS technologies. While holding the potential to mitigate the release of carbon emissions from fossil-fuel power generation (and other large point source carbon emitters), investment in CCS technologies has a number of ethical, moral and environmental implications. Not only would investment in CCS stand to prolong the use of fossil through Enhanced Oil Recovery, but it would also require the long-term underground sequestration of captured CO_2 [5]. As such, each group was invited to comment on their thoughts and perceptions of the technology.

The concept of CCS received mixed approval among all three groups. While the majority of participants believed that human activity was at least partly responsible for climate change, perceptions about the severity of the effects of climate change and likely time-frames influenced the acceptability of CCS as a solution. Secular participants argued that all possible actions should be taken to both mitigate against and adapt to climate change, including addressing resource consumption and distribution, developing alternative low carbon technologies and promoting more sustainable life-styles. CCS was seen as an essential component to a whole package of measures. Secular participants did not subscribe to beliefs in divine intervention and therefore argued that humans were solely responsible for their own fate. They demonstrated a high level of concern about climate change, emphasising the need for CCS:

> *"CCS is an important part of the solution … I don't think it's a waste of money … we need to start decarbonising the economy incredibly quickly in order to have a chance of not reaching three degrees by 2100."*
>
> *Jonathan, Secular.*

Christian and Muslim participants similarly argued that changes to lifestyles were required, discussing scriptural warnings against greed and over-consumption and the need to fairly distribute resources. Muslim participants rejected CCS on moral grounds as an abuse of the balance of nature and of their responsibility to Allah as stewards. In contrast, Christian participants on the whole, viewed modifications of the environment which could promote human welfare positively. However, they wanted to know more about the cost of CCS and possible risks.

All participants focused on the advantages of behavioural change. Muslims participants regarded damage of the environment as immoral regardless of whether humans were negatively impacted; while secular participants spoke about CCS as being "a cheat's way out", a "quick fix" and a "conscience cleaner" deterring people from adopting sustainable lifestyles. Greater "efficiency will go in the rebound […] if we don't change our behaviour" commented one secular participant. For Muslim participants greed and over-consumption of natural resources was inexcusable, even if the waste could be contained, because of human accountability to God for the use of creation. For Christian participants concerns centred on the long-term capacity of CCS to promote human welfare by ensuring energy security. They were aware that fossil fuel reserves were limited.

Muslim participants were uncomfortable with the idea of CO_2 storage. The negative perception of CCS stemmed from their focus on harmony and balance principles and their responsibility to act as stewards, protecting Allah's creation and preserving it for future generations:

> *"[E]ach generation has their own challenges but we should give them the earth in the best shape […] we should be trustworthy guardians of nature and we should minimise any effect which could last for long […] we need to work for a global common good."*
>
> *Azlan, Muslim.*

The group considered the continuing burning of fossil fuels, high consumption and the burying of unwanted emissions as selfish and irresponsible.

Christian participants expressed concern for human welfare, focussing on future energy security in light of depleted fossil fuel reserves and issues with renewable technologies such as their relatively high-cost. The group demonstrated a low level of awareness about climate change and its possible effects. This made it difficult for them to assess the risks of CCS and geological CO_2 storage relative to the impacts of unmitigated climate change. However, their focus on modification of the environment to promote human welfare did lead to some positive comments on CCS, albeit with reservations about cost: "Sounds good … I imagine it will be expensive to capture and store" (Robin).

4. Discussion

The aims of the present study were to explore potential differences between Muslim, Christian and secular participants in terms of pro-environmental values and beliefs and to explore attitudes to climate change and CCS. The main findings from each group will be discussed in turn before moving on to consider the implications of the research, some research limitations and future research directions.

4.1. Secular participants

While all three groups had relatively high NEP scores indicating a strong pro-environmental orientation, these were most pronounced in the secular group. The secular focus group discussion complimented this finding, showing the participants to have a high level of engagement with the political and scientific debate on climate change and to see environmental issues as a high priority. These participants argued that immediate action needed to be taken in order to reduce anthropogenic CO_2 emissions. While behavioural change and fairer distribution of resources were seen as part of the solution to the serious environmental and human-population issues, it was believed that technologies such as CCS would also be required. CCS was therefore accepted as necessary despite some reservations. This was because the risk of climate change and its impacts on human and other life forms were seen as a higher risk than CO_2 capture and geological storage. Without beliefs in a deity the secular group saw humans as solely responsible for their own fate and for regulating their behaviour in order to co-exist with other species. The comparatively high level of engagement with environmental issues and sense of urgency among the secular participants appears to support the findings of larger studies which suggest that individuals who do not subscribe to beliefs in an afterlife are more engaged with current issues such as climate change [15,19,20].

4.2. Muslim participants

Muslims had the second highest NEP score and focus group data revealed strong conservation and harmony principles stemming from religious teachings as hypothesised by Whitford and Wong (2009) [23]. Muslim participants used the Qur'an and Hadith as an ethical code providing them with detailed guidance on the relationship between humans and the environment. This authoritative scriptural guidance promoted living in harmony with nature, maintaining the balance of ecosystems and resource conservation. They drew attention to passages of the Qur'an which set out their responsibility to take care of Allah's creation for the next generation.

When Muslim participants were presented with information about CCS technologies with which they were unfamiliar, they appeared to refer to these scriptural principles to assess the possible ethical and moral considerations related to the capture and storage of CO_2. While perceiving climate change to be a risk and acknowledging the negative impacts of humans on the environment, Muslim participants expressed strong reservations about the use of CCS and instead favoured behavioural change and renewable technologies. Their theocentric beliefs led them to argue that all creation should be valued and that damaging the environment was morally wrong. This indicates beliefs in the intrinsic value of nature and makes

using the environment to bury human waste (including captured CO_2) problematic. The participants conceived of the environment, not as a resource to be exploited, but as a testimony to Allah and a reminder of their duty as custodians.

4.3. Christian participants

Christian participants appeared to place greater emphasis on anthropocentric values than the other participants and while all three groups had relatively high NEP scores indicating a pro-environmental orientation, this was least pronounced in the Christian participants. Nonetheless, the Christians' focus on human welfare and belief that humans should have an active role as co-creators or "redeemers" in shaping and to some extent controlling their environment made them more willing to accept CCS as a way of mitigating climate change than the Muslim group.

Christian participants expressed uncertainty about both the causes and effects of climate change and as suggested by the literature appeared to have a lower awareness about and engagement with the current political and scientific debate than secular participants [15,16,20]. The number of references to an afterlife where God would restore creation was notable. Present life on earth was described with some ambivalence; creation was good because it was made by God but it was also fallen and filled with suffering and death. The idea that God's Kingdom was "present but not yet" (Joshua) gave the Christian debate a greater focus on the idea of transition, where humans had the role of redeemers in working for a better future. This idea of the coming kingdom led to a theme of expected disturbance and strife which distinguished it from the themes of harmony and co-evolution which characterised the Muslim and secular debates. Nature was therefore seen both as something to be stewarded and in some ways controlled. For these Christians, environmental stewardship was important, but their level of engagement appeared lower than in the other groups.

It is perhaps unsurprising that Christian participants had little to say on the ethical aspects of CCS given their uncertainty about the causes and effects of climate change. The group had a strong anthropocentric focus, with environmental stewardship being justified by its benefits to human quality of life. Modification of the environment was seen as largely beneficial where it promoted human welfare. Accordingly the group were interested in the likely costs of the technology and risks of CO_2 storage to health.

4.4. Contribution, limitations and directions for future research

It appeared that the beliefs of Muslim and Christian participants in a benevolent deity with power to intervene in the human situation, and in the existence of an afterlife, affected risk perception in relation to climate change and by implication acceptance of CCS. Muslim participants argued that they must do their best to live within their means and act as good custodians of the environment. However, like the Christian participants they trusted in God to assure their ultimate welfare. Similarly, Christian participants spoke in terms of the eventual redemption of the natural world and talked in time-frames including eternity.

While religious guidance could be seen as a motivator for pro-environmental action, reduced consumerism and the promotion of social justice; beliefs in an afterlife and divine intervention reduced perceptions of risk-urgency. The more relaxed attitude of religious participants, especially in relation to population growth is in clear contrast to that of their secular counterparts. In the secular group there was a sense of great urgency because participants believed humans were ultimately and solely responsible, as rational beings, for their own future and for the environment. These differences in risk-perception could have implications for climate change mitigation including the transition to cleaner fossil fuel technologies such as CCS. While all the groups preferred renewable technologies coupled with behavioural change as a solution to climate change; it was the sense of extreme urgency which led secular participants to accept a broader range of technological and behavioural solutions including CCS as necessary.

This exploratory mixed methods study investigated potential differences in pro-environmental values and beliefs between Christian, Muslim and secular participants; groups which were identified by the 2011 Census as forming around 89% of the population of England and Wales [13]. The study can be viewed as a contribution to the dialogue about the role that religious faith might play in shaping opinions about climate change and the acceptability of proposed policies and technologies for mitigation and adaptation. While both secular and religious groups demonstrated pro-environmental attitudes (with the majority also believing that climate change was at least partly attributable to human CO_2 emissions), religious faith clearly affected opinions about the urgency with which action should be taken as well as attitudes to the use of CCS as a means of mitigating this threat.

The study provided some insights into the motivations of religious and secular participants for engaging with environmental issues, with Muslim and Christian participants discussing religious obligations to act as environmental stewards and to consider the welfare of present and future generations because they would be held accountable by God. Muslim participants appeared to be motivated by conservation principles as outlined in religious texts and spoke about the restoration of balance in natural systems, while Christian participants saw change and suffering as part of God's coming Kingdom and spoke about their role as redeemers and co-creators. Secular participants appeared to be motivated by feelings of responsibility and discussed the need for humans to co-evolve with the environment in order to ensure future human survival and to preserve ecological diversity.

Although this was a small-scale study it gives some indication of the complex interactions between core values and beliefs (e.g. about the relationship between humans and the environment and reasons for environmental responsibility) and attitudes to environmental issues and mooted technological solutions to these issues. Despite slight increases in public awareness of CCS in recent years, the technology remains new and unfamiliar to most people

[43]. This lack of familiarity is likely to mean that public opinion will rest more on the interpretation of communications about the technology than on direct personal experience [8, 43]. We argue that religion may provide an important lens for such interpretation and, as such, suggest that more should be done to investigate how religious faith may shape and influence public perceptions of technological innovations, like CCS. Such understanding could prove valuable in shaping communication strategies and public discourse around such innovation.

This study has some limitations which should be acknowledged. Our sample was recruited through the University of Sheffield and affiliated organisations (e.g., the Multi-faith chaplaincy and Muslim Welfare House) and because of this our participants tended to be university educated and of a similar age. Furthermore, this small-scale qualitative study focused only on Sunni Muslims and Protestant Christians in investigating religious beliefs, values and attitudes. Future studies could usefully consider running focus groups with participants who are not University-educated and map to a broader range of denominations (e.g., Catholic Christians and Shia Muslims) and other faiths. For example, the 2011 Census revealed that after Christian, secular and Muslim faith communities Hindu (1.5%), Sikh (0.8%) and Jewish (0.05%) faiths are the best represented in England and Wales [44]. As such, future studies might wish to replicate the current study design with such groups and compare the responses of these groups to those detailed within this article. Equally, the current study was designed and run within a UK socio-political context; arguably one might anticipate that there could be some differences in participants resident in countries with different energy and environmental policies (e.g., less stringent CO_2 emission targets). Finally, in order to develop more generalisable findings from this research, we argue that there would be value in designing and distributing a nationally representative survey to investigate general trends in attitudes to environmental issues and proposed technological solutions in relation to religious faith.

5. Conclusion

In summary, while all the groups were pro-environmental their reasons for environmental concern varied. Religious beliefs shaped concepts about the relationship between humans and the environment, with Muslim and Christian participants referring to divine creation and the God given responsibility of stewardship, while secular participants spoke about evolution and human responsibility to self-regulate and co-exist with other species. When considering the future role of CCS in the UK, Muslim participants referred to religious texts to argue that continued burning of fossil fuels and the geological storage of waste CO_2 would be immoral because they could disrupt the balance of nature, leave a dubious inheritance for future generations, and would constitute poor stewardship of Allah's creation, for which they would be judged. Christian participants also referred to scripture but focused on human welfare and the commandment to love others to guide their discussion on the relationship between humans and the environment. Modification of the environment was deemed acceptable where human welfare was promoted, meaning that while there were concerns about the cost and safety of CCS, no serious ethical objections were raised. The secular participants argued that the risks of climate change exceeded those of CO_2 storage, calling for a range of measures including CCS to be used to address CO_2 emissions.

Acknowledgements

This research was conducted with funding from the EPSRC E-Futures DTC at the University of Sheffield. The authors would like to thank David Chalcraft, Fiona Scott, Peter Atkins, Christine Rowland and James Andow for their assistance with this study and Chris Spencer for his comments on a previous version of the article. Finally we would like to thank all our participants for their contribution to this research.

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