

Explaining variation in acceptance of homosexuality:

Testing a cultural evolutionary hypothesis

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Abstract

We report the results of two studies that test the kin influence hypothesis, an hypothesis which proposes that the change in societal structure which occurs with economic development initiates a long process of cultural evolution which partly accounts for the rise in acceptance of homosexuality in some populations. The hypothesis predicts two patterns will exist in the variation in acceptance of homosexuality. The first study provides support for the first prediction, that individuals are slightly less likely to express acceptance of homosexuality during interactions with a child. The second provides support for the second prediction: the pattern of variation in a cross-national sample is consistent with the proposal that individuals from all populations which have begun to experience economic development are experiencing a similar cultural change process and variation is related to the extent of their progress along that process. A model consisting of variables suggested by cultural evolution models fits the data better and explains more variance than a model consisting of variable suggested by an ecological model of cultural variation.

Introduction

In 2005, a cultural evolutionary hypothesis, called “the kin influence hypothesis”, was proposed as a partial explanation for the rapid cultural changes that accompany economic development (Newson et al., 2005). This article and most of the subsequent research which has looked at kin influence on reproductive behavior has considered the hypothesis as an explanation for change in child-bearing behavior. This article will report research which considers the hypothesis as an explanation of current variation in acceptance of homosexuality.

Testing cultural evolutionary explanations of cultural variation is difficult. A fundamental assumption of cultural evolution is that a change experienced by a population may have a small effect on its culture at the time it occurs but that the effect of the change may continue, driving a long process of cultural evolution (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981). This is easy to demonstrate with mathematical models and it is also relatively easy to appreciate when the change event involves specific new information becoming available to a population. For example, the knowledge gained in Faraday’s experiments with electricity in the 1820s and 30s made little impact on people’s lives at the time but this new information triggered a process of technological innovation which transformed, and continues to transform, the way humans live. Cultural evolutionary processes are less easy to appreciate, however, if the change event causes less specific changes in the information exchanged within a population. In these cases, the small persistent effects of the change may be obscured, particularly when many different kinds of environmental and cultural changes are occurring simultaneously.

The kin influence hypothesis proposes that a process of cultural innovation is set in train by a general change in the information exchanged in a population that occurs after the population begins to experience economic development. It is caused by changes in the social structure of the population that are associated with economic development (Newson, 2009; Newson et al., 2005; Newson et al., 2007; Newson & Richerson, 2009). These changes have been documented and described many times and in many ways by scholars from many disciplines. Prior to economic development, most people live in relatively small rural communities in which people are connected with personal ties and shared interests and traditions (Durkheim, 1984/1893).

Their strongest identification is with their “family” (variously defined and sometimes including members who are not genetically related) and family allies (Anderson, 1992; Wilson, 1976). The “family” is the main social institution, providing education and organizing employment for its members as well as supplying their welfare needs and cooperating in raising the next generation (Davis, 1937; Hrdy, 1999). With economic development, individuals begin to migrate away from their natal communities to new centers of employment (Zelinsky, 1971). Other social institutions take over many of the roles of the family (Davis, 1937). Social networks become wider and shallower (Bongaarts & Watkins, 1996; Kohler, 2001). People identify themselves as belonging to a number of social groups (Iyer et al., 2009; Tajfel, 1978).

It is reasonable to suspect that this change in the social environment would initiate a cultural evolutionary process because in this novel environment people begin to receive a much higher proportion of social information from non-family members through either face-to-face contact or via communication media. This is likely to cause a permanent change in the content of the information people receive. When the social structure of a population ensures that a large proportion of social interaction is between individuals who have a shared interest in the welfare of their family, the population will maintain a suite of cultural norms which promote the family and its interests, especially the vital purpose of raising the next generation (Newson et al., 2007). These norms encourage individuals to perceive the interests of their family to be identical to (or more important than) their own interests and preferences. Thus, women in such communities often consent to marry a man they do not know who is chosen for them by or agreeable to family elders (Apostolou, 2007). Men also acquiesce to the wishes of their elders and, if deemed necessary, risk their lives fighting to defend or expand the resource base of their family and its allies (Bowles & Gintis, 2011).

As a population begins to experience economic development, societal structure changes so that individuals spend more time with non-family members and begin to gain information from media. Initially, the information exchanged in these novel information communities is not very different from that exchanged in communities with the old structure because people pay most attention to information consistent with norms they have already adopted (Hovland et al., 1953). However, the total information exchanged in this new social environment will less emphatically argue for the interests of the family. Year-on-year this will cause the cultural norms to change so that they increasingly diverge from those of populations with a more kin-connected community structure. Potentially, all norms which influence behaviors of interest to the family are affected, including sexual behavior, parenting behavior, gender roles and obligation to kin. The cultural changes predicted by the kin influence hypothesis are consistent with changes observed to be associated with the early stages of economic development, often referred to as the “modernization” of culture (Inkeles, 1975; Newson & Richerson, 2009).

The possibility that reduction in influence from kin may explain, or partly explain, the dramatic decline in fertility that is associated with economic development has been considered by a number of researchers attempting to explain variation in women’s reproductive decisions (Alvergne et al., 2011; Mace & Colleran, 2009; Mathews & Sear, 2013a, 2013b; Mulder, 2009; Shenk et al., 2013). Their analyses have included measures of contact with kin along with variables representing a number of other factors (e.g. level of education, wealth, employment, personality and socio-economic status). Such analyses treat contact with kin as an ecological variable and do not consider the reduction in influence of kin as having initialized a cultural evolutionary process but they do test an important assumption of the kin influence hypothesis,

which is that, all things being equal, individuals are slightly more inclined to encourage their kin to behave in ways likely to enhance their reproductive success and slightly less inclined to encourage their kin to behave in ways likely to reduce their reproductive success (Newson et al., 2007). Thus, in low-fertility affluent populations, the hypothesis predicts that individuals who have had more contact with kin will have received slightly more encouragement to reproduce and that their behavior will reflect this. Analyses of the reproductive outcomes of British women suggests that this is the case (Mathews & Sear, 2013a, 2013b). In a longitudinal study, those who reported more contact with kin were likely to have first child at a younger age and be more likely to go on to have a second child.

An analysis of factors affecting variation in beliefs about homosexuality provides a way to test predictions the hypothesis makes about the longer term effects of the decline in kin influence. It allows us to determine the extent to which the pattern of variation is consistent with the proposal that a decline which occurred in a population's past is continuing to drive cultural change. In recent decades, the belief that homosexuality is acceptable has increased in a number of populations (Andersen & Fetner, 2008a). The populations in which acceptance is highest, those often referred to as "Western" are among those which were the first to become economically developed (Inglehart & Norris, 2003; Newson & Richerson, 2009).

A great deal of the cultural change experienced by Western populations over the last 150 years has been in beliefs and behavior of interest to the family. In the 19th century young adults of European descent began to abandon the belief that it is desirable to raise as many healthy children as possible (Caldwell & Ruzicka, 1978; Coale & Watkins, 1986). At the time, this change caused considerable alarm to some (e.g., National Birth-Rate Commission, 1916). Similar alarm greeted a number of other cultural changes that had implications for families. During the 19th and early 20th century, young Westerners began to see marriage less as the formation of a reproductive partnership and more as the union of two people who thought they would be happy together (Burgess & Locke, 1945). Ideas about what constituted a "suitable spouse" changed rapidly. When a group of undergraduates attending the University of Wisconsin in 1939 (346 males and 282 females) were asked to rank the importance of a number of considerations when choosing a marriage partner, "mutual attraction – love" was ranked fourth overall by men and fifth by women. Men chose "dependable character" as the most important attribute to look for in a prospective wife and women saw "emotional stability" as most important in a husband (R. Hill, 1945). American university undergraduates were asked to rank the same list in 1956, 1967, 1977, 1984/5 and 1996 (Buss, 2001). "Mutual attraction – love" rose in the ranks in later surveys and lodged firmly at number one in 1977 for females and in 1984/5 for males. Many married couples found that their mutual attraction and love began to weaken. Divorce became increasingly acceptable and then common during the 20th century (Blake, 1977; Stone, 1990). It also became acceptable and then common for children to be born to parents who were not married (Raley, 2001; Van de Kaa, 1987). The idea that marriage should be available to same-sex couples is the most recent in a long series of changes in beliefs about marriage that occurred in the West during the last 150 years. See Figure 1 for a graphical summary these changes.

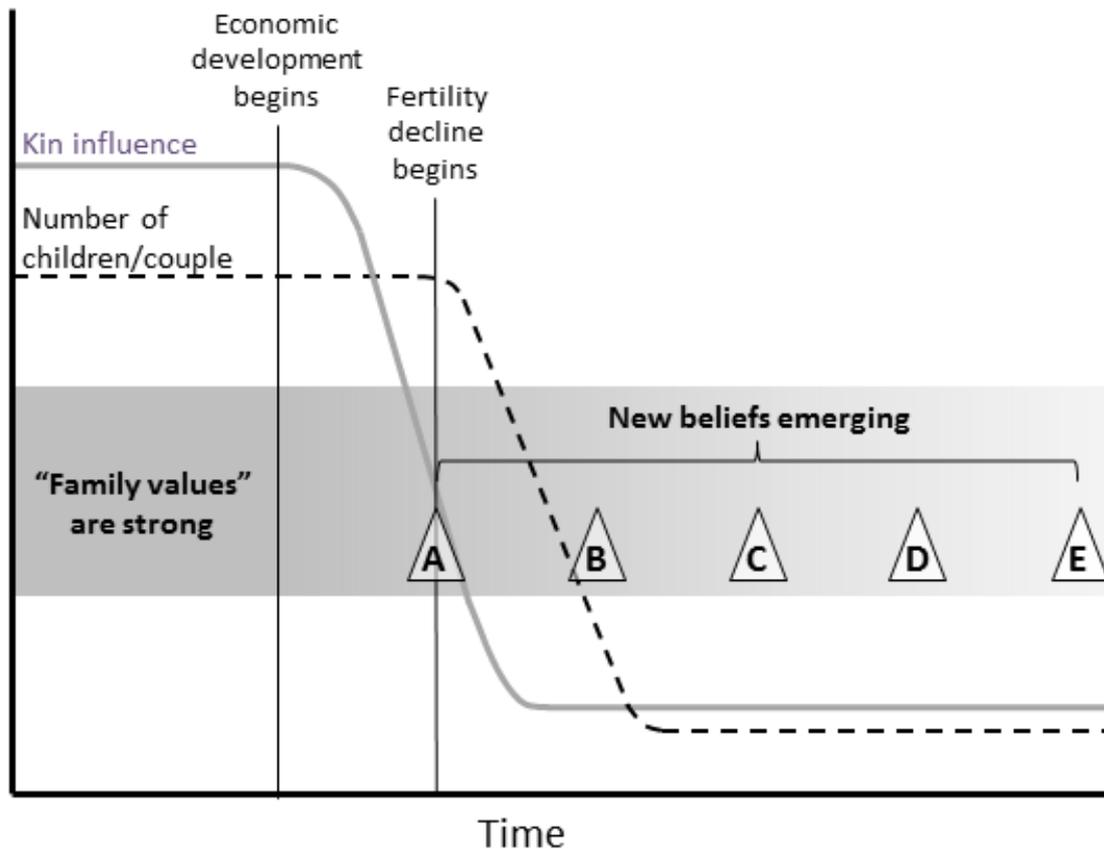


Figure 1: Economic development and change in cultural norms related to the family

A depiction of the evolution of norms related to the family which has been experienced by Western populations since they began to develop economically in the 18th and 19th centuries. Among the “family values” people held prior to economic development was the perception that the purpose of marriage is to ensure that babies are born into a family system that will provide care. Young people are expected to marry a person their elders approve of and to raise as many children as they can. Once the couple has produced children, their marriage is considered to be a lifetime commitment.

As economic development proceeds, kin influence declines as people begin to work and be educated outside the family. Literacy and communication technology also increase influence from non-kin.

Examples of new beliefs that emerge once people have less interaction with kin:

- A. It is acceptable for couples to limit the number of children they have if they want to.
- B. People should marry someone they are in love with and who makes them happy.
- C. Even if they have children, couples can end their marriage if one or both of them is unhappy.
- D. Divorced and single people and unmarried couples can make perfectly good parents.
- E. If homosexual couples are in love and want to marry, they should have the right to do so

If the increased acceptance of homosexuality is part of a cultural evolutionary process initiated by the decline in influence from kin then two patterns will exist in the variation of acceptance:

1. An individual's expression of acceptance of homosexuality is slightly influenced by fitness considerations. The difference is slight because the norms of the group an individual identifies with have a powerful influence. But in general, individuals in all cultures are more inclined to encourage their kin to behave in ways likely to increase their reproductive success (Newson et al., 2007). In Western cultures a preference for same-sex sexuality is associated with lower reproductive success (Bell & Weinberg, 1978; S LeVay, 1996) so Westerners will be less likely to communicate encouragement of homosexual behavior to their children than to non-relatives.
2. Patterns of variation in acceptance of homosexuality in a cross-national sample will suggest that populations which have begun to develop economically are proceeding through a similar cultural evolutionary process. Their acceptance of homosexuality will be related to how far along that process the culture of their population has progressed.

This paper includes reports of two studies performed to test these predictions.

Study One – Family context and encouragement of homosexuality

To determine if individuals are less inclined to communicate acceptance of homosexuality when interacting with their offspring, we performed an internet-based study similar to that reported in Newson et al (2007).

Method

Internet users were informed about a study looking at how circumstances influence opinion about homosexuality via Facebook or email lists, such as the University of Exeter Psychology Department subject panel, University of the Third Age, a subject recruitment website, and a lifestyle blog (<http://www.advicegoddess.com/goddessblog.html>).

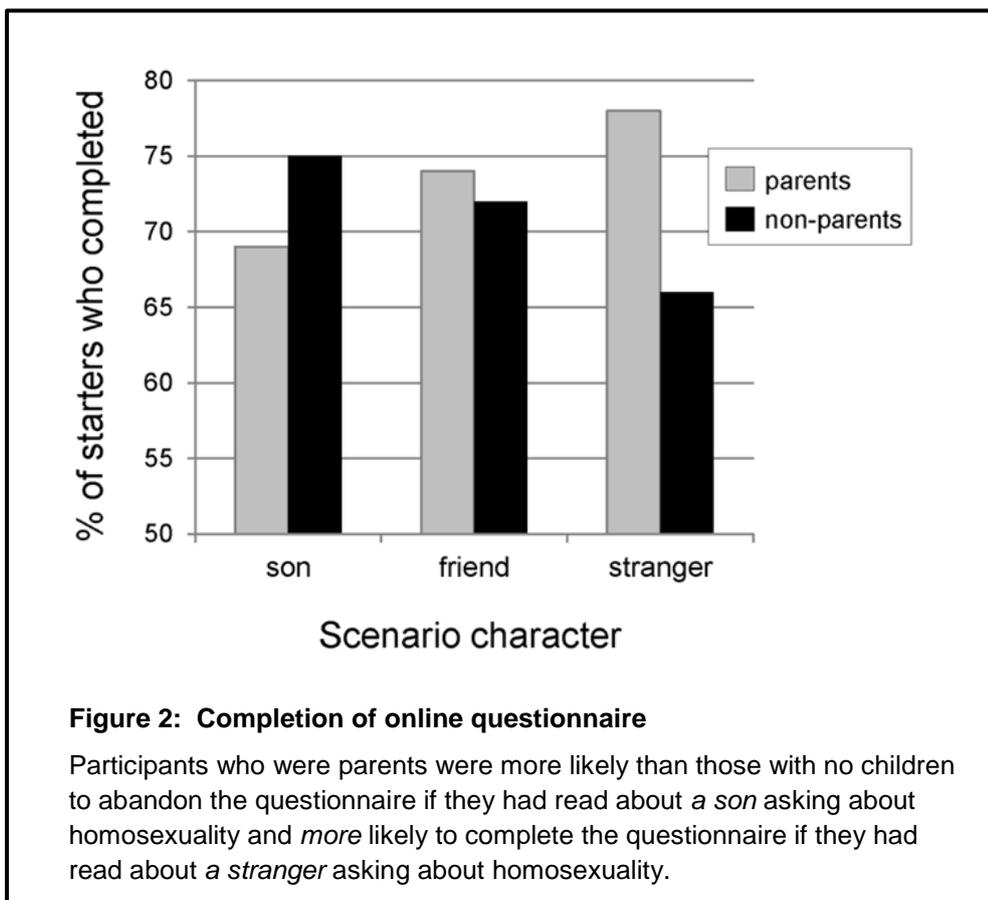
Those agreeing to take part in the study were randomly assigned to one of three conditions (son, friend or stranger) by being linked to different questionnaires. After supplying demographic information, participants were asked to read a vignette about a male asking an older person about homosexuality and then to write what they thought the older person would say. Participants read different vignettes depending on their gender so that their gender matched that of the person who was asked for advice. The relationship between the older person and the younger person was depicted as a son, a friend or a stranger depending on the condition to which the participant had been randomly assigned. Copies of the vignettes are included the supporting information (Document S1). The participants were then asked questions about the advice they might give in the situation they had just read about, their opinions about homosexuality in general, and their own sexual experiences and preferences.

Of the 1163 people who began to fill in the online questionnaire, 1123 (96.6%) completed the initial questions asking for demographic information. Of these, 45% reported that they lived in the United States, 40% reported that they lived in the United Kingdom and 10% said they lived in other European countries or in Canada, Australia or New Zealand. The remaining five per cent reported living in a variety of countries but a number of these said that they were from the United States or a European country. The participants were 37.8% male and 43.4% of them were parents.

Results were analyzed with IBM SPSS 20.

Results

Of the 1123 participants who completed the demographic information section of the questionnaire, 807 (71.9%) completed the study. Neither the age nor the gender of the participant influenced whether he or she completed the study but the condition to which they were assigned and whether or not they were themselves parents did. In general, participants who were parents were more likely to complete the questionnaire than those with no children but those who were parents and who read a vignette about *a son* asking about homosexuality were, in a logistic regression model that controlled for age and gender, less than half as likely to complete the study ($p > 0.01$) (see Figure 2).



The responses of participants who did complete were not found to vary in relation to the condition they had been assigned and their responses suggest that the people attracted to the study had high acceptance of homosexuality. Of those who said they were heterosexual (78%), nearly half said they strongly agreed with the statement "Homosexuality is an acceptable alternative lifestyle". Less than five per cent said that they strongly *disagreed* with the statement. Women, younger people and non-parents were slightly more likely to agree.

Discussion

Results of studies with self-selected participants can be valid if the participants are randomly assigned to different experimental conditions and their responses in the different conditions compared. In an internet sample, however, individuals who start a study self-select whether to complete it. If this choice is influenced by the condition to which they were assigned, then the assignment of those who finish the study is not random. In such cases, whether or not a participant completed the study is the only response that can be compared in the different conditions.

Participants who had no children were most likely to complete the study if they had been assigned to the condition in which they were asked to think about advising a son about homosexuality. The opposite was true for participants who were parents. We can only speculate about why parents were more inclined to abandon the study if they had been assigned to the parent/son condition. The most likely explanation is that imagining advising a son about homosexuality is a different experience for a person who actually has a child than for someone whose only experience of the parent/child relationship is that of being the child. A parent imagining advising his or her child might have found the questionnaire to be more difficult or less interesting than imagining advising a stranger. Non-parents may have found advising a stranger to be more difficult or less interesting.

The results of this study are, however, consistent with the prediction of the kin influence hypothesis that people will be less inclined to communicate acceptance of homosexuality to their children even though their beliefs are still strongly influenced by the norms of their culture. Many participants in the mostly Western sample may have seen participation in the study as way of confirming their adherence to norms of acceptance of homosexuality. Those who were parents and who were exposed to a prime which made them think about advising a son about homosexuality may have felt uncomfortable about expressing their acceptance of homosexuality but also felt uncomfortable about making responses which were inconsistent with the norms of acceptance that they had adopted. For some of these participants, the solution was simply to not complete the study.

Study Two – Patterns of variability in acceptance of homosexuality in a cross-national sample

In all populations which have undergone the societal changes associated with economic development reproductive age members adopt the belief that it is prudent to limit family size and the population experiences fertility decline. If, as proposed by the kin influence hypothesis, this is an early stage in a cultural evolutionary process involving changes in norms that affect the family, then populations which have experienced fertility decline will also, in time,

experience changes in other norms influencing behaviors that affect the interests of the family, such as norms regarding marriage and sexual behavior. The hypothesis therefore predicts that the more time that has passed since fertility began to decline in a population, the more likely its members will be to accept homosexuality. Other predictions include:

- younger people will be more likely to accept homosexuality because they were socialized later in the cultural evolutionary process;
- people who give the “trusting” response to “the trust question” often asked in social surveys (Glaeser et al., 2000) are more likely to be accepting because they are likely to have wider social networks including more people from outside their family;
- people who spent more years in formal education will be more accepting because they are likely to have experienced more influence from non-family members;
- the more strongly a person believes in the acceptability of divorce, the more likely he or she is to believe in the acceptability of homosexuality because acceptance of divorce is part of the same cultural evolutionary process as acceptance of homosexuality.

These predictions can be tested by an analysis of data collected by the World Values Survey (European and World Values Surveys, 2009). From 1997 to 2008, representative samples of people living in 85 countries (a total of over 180,000 respondents) were asked a question to determine the degree to which they accepted homosexuality:

“Please tell me for each of the following statements whether you think it can always be justifiable, never be justifiable or something in between, using this card”.

Among the statements is the word “Homosexuality”. Respondents chose a number on the card between 1 (“Never Justifiable”) and 10 (“Always Justifiable”).

The dataset also includes responses to questions revealing information about the respondents’ age, education, religion, how justified they believe divorce to be and “the trust question”. Although language and cultural differences place some limitations on the equivalence of the responses of people living in different countries, this dataset is a useful tool for comparing how well different combinations of individual-level and country-level variables explain the pattern of variation in acceptance of homosexuality. Samples from this dataset have already been analyzed to test other hypotheses that have been proposed to explain patterns of variation in acceptance of homosexuality (Adamczyk & Pitt, 2009; Andersen & Fetner, 2008b; Inglehart & Norris, 2003).

Cultural change often alters the physical and informational environment of a population in many ways and the small but persistent effect of a process such as the one described by the kin influence hypothesis is likely to be only one driver of cultural change. Highly visible environmental changes occurring concurrently might appear to be causing the behavioral changes. Simply showing that a hypothesis suggests predictors that “explain” variation in a statistical sense implies that reality is simpler than it really is (Burnham & Anderson, 2002). It is more useful to compare models based on different cultural change hypotheses and determine which combination of variables creates a model that fits the data best (Efferson & Richerson, 2007).

We therefore compare the explanatory power of a model based on the kin influence hypothesis with models based on the two other kinds of cultural change hypothesis that can be envisaged as a reason for variation in belief about homosexuality:

1. An “ecological hypothesis”, which proposes that cultural change occurs because of concurrent changes in the environment that incline people to be more or less accepting of homosexuality. Individuals have different levels of acceptance of homosexuality because they are exposed to different socio-ecological conditions.
2. A “specific information cultural evolutionary hypothesis”, which proposes that cultural change occurs because of the earlier introduction of changes in specific information about homosexuality that incline people to be more or less accepting of homosexuality. Individuals have different levels acceptance of homosexuality because they have been exposed to different information about homosexuality.

The analyses of samples from the World Values Survey dataset that were carried out by Adamczyk and Pitt (2009) and (Andersen & Fetner, 2008b) found patterns of variation in acceptance of homosexuality to be consistent with an “ecological hypothesis”, the materialist-postmaterialist value change thesis (Inglehart, 1987). This hypothesis proposes that the degree of scarcity and security that exists in the society in which an individual grows up influences the degree to which they develop “materialist” values emphasizing economic and physical security. Those growing up in societies with greater prosperity and security develop “postmaterialist” values emphasising autonomy and self-expression (Inglehart, 2008). Postmaterialists, the hypothesis proposes, are more tolerant of diversity, including diversity in sexual behavior. Andersen and Fetner (2008b) note that members of society do not benefit equally from economic development and so suggest that individual differences in acceptance of homosexuality are partly explained by individual financial security and social class. Adamczyk and Pitt (2009) further add the suggestion that since religion can be considered a form of self-expression, individuals may fail to develop a tolerance of homosexuality if they perceive non-acceptance of homosexuality to be an expression of their religious belief.

The materialist-postmaterialist value change thesis suggests, therefore, that a respondent’s acceptance of homosexuality is predicted by measures of the level of wealth and wealth inequality of the country in which they grew up and by a number of individual-level variables available from the World Values Survey dataset. Measures of social class and individual wealth are comparable among some of the countries included in the World Values Survey dataset (Andersen & Fetner, 2008b) but not among all of the countries sampled. Of the measures that the survey provides across this wider range of countries, we judged that the number of years the respondent reported spending in formal education to be best proxy for his or her social class and wealth (Breen & Jonsson, 2005).

Herek (2004) is essentially proposing a “specific information cultural evolutionary hypothesis” with the first sentence of his paper: “Two historic events occurred in the early 1970s, each with profound consequences for later discourse about sexual orientation in the United States and much of the rest of the world” page 6. The first event was the publication of a book called “Society and the Healthy Homosexual” (Weinberg, 1972) in which Weinberg presented the word “homophobia” to describe entrenched thinking about the “problem” of homosexuality. The second event occurred a year later when the American Psychiatric Association Board of

Directors voted to remove homosexuality from its *Diagnostic and Statistical Manual of Mental Disorders* (DSM), stating that a same-sex orientation is not inherently associated with psychopathology. After this, increasing numbers of people publically declared themselves to be homosexual and thus the public became increasingly familiar with homosexuals through personal interaction and the media. With increasing familiarity came increasing acceptance (Herek, 2009). Scientists began to look for biological factors that may cause some people to have a same sex sexual orientation (Simon LeVay & Swaab, 1996). Their speculation was widely covered by the media and the suggestion that some people were innately homosexual (and therefore had no choice about whom to love) became, for many Westerners, justification for supporting what became the LGBT movement (Lewis, 2009). People with a sexual orientation different from that of the majority were framed as a quasi-ethnic minority group and the responses of the heterosexual public were shaped by earlier movements for civil rights for racial and ethnic minorities.

Whether or not a respondent is homosexual or personally knows “healthy homosexuals” is likely an important source of variation in acceptance of homosexuality but the World Values Survey dataset does not include this information. A number of country-level variables do, however, provide an indication the respondent’s exposure to information likely to increase their acceptance of homosexuality. The popular media, at least in Western societies, became a source of information about homosexuality. Interviews, documentaries and dramas were broadcast which familiarized people with homosexuality. To be exposed to this information, individuals need access to communication technology so the number of televisions per thousand people in a country provides a country-level variable indicating the likely exposure of an individual to this media content. However, not everyone with access to television would have had the same exposure to this information. Most of those living in countries allied with the Soviet Union, for example, did not have access to Western media until the 1990s. Countries in which the Muslim religion is very influential would also likely have had less exposure to Western ideas about homosexuality. This would predict less acceptance of homosexuality in former Soviet bloc countries and in countries where most of the population (>90 per cent) is Muslim. If, as Herek (2009) suggests, much of the new information originated in the United States, we might also expect English-speaking countries to be more accepting.

Participation in religion, meanwhile, may have provided people with information likely to discourage acceptance. Some religious texts, particularly those of the Abrahamic religions, include statements discouraging homosexuality. A “specific information cultural evolutionary hypothesis” therefore also suggests that adherence to the beliefs of at least some religions will predict acceptance of homosexuality.

Thus, individual-level and country-level variables are available that will allow a comparison of models based on three different kinds of cultural change hypotheses to determine which best explains the pattern of variation in acceptance of homosexuality in the World Values Survey dataset. See Table 1 for a summary of the three models and the variables suggested by each. These three models can then be compared with the model created by recombining the variables to produce a model that best fits the data and explains the most variance. Creating such a composite model reflects the likelihood that more than one process is contributing to the variation we observe.

Table 1. Summary of models compared in the analyses

Hypothesis	Description	Individual-level variables	Country-level variables
1. The kin influence hypothesis	a cultural evolutionary hypothesis proposing that change is driven by a continuing decline in encouragement of family-supporting behavior due to a change in the structure of society that occurred in the past	<ul style="list-style-type: none"> • age • trusting response? • years in formal education • acceptance of divorce 	<ul style="list-style-type: none"> • number of years since fertility began to decline
2. Exposure to specific information about homosexuality	a cultural evolutionary process proposing that change is driven by earlier introduction of specific information about homosexuality to the population which influences the evolution of beliefs about homosexuality.	<ul style="list-style-type: none"> • religious denomination • religion important? 	<ul style="list-style-type: none"> • televisions/1000 people • formerly in Soviet bloc? • > 90 per cent Muslim? • English speaking?
3. The materialist-postmaterialist value change thesis	an ecological hypothesis proposing that change is driven by changing environmental conditions which make people feel more secure so that they become more tolerant of diversity including sexual diversity	<ul style="list-style-type: none"> • age • trusting response? • years in formal education • religious denomination • religion important? 	<ul style="list-style-type: none"> • mean wealth (GDP/capita) • wealth inequality (Gini index)

Method

The World Values Surveys dataset was downloaded from the World Values Survey Website (<http://www.worldvaluessurvey.org>). Respondents surveyed in years 1997 to 2008 were deemed eligible for the study if they were aged between 18 and 80, had answered all the questions that would provide the individual level variables for the analyses and lived in a country for which the country-level variable information is publically available (see Table S1 for country-level information and sources). This provided a sample of 152,165 participants from 85 countries. To ease statistical calculation the size of the sample was reduced by randomly selecting half of these participants. The year that the survey was performed was included as a variable in all the models.

The variation in responses to the homosexuality question was not normally distributed. Over half the respondents (52.8%) chose “1” (i.e. that homosexuality is “Never” justified). The dependent variable therefore did not meet the assumptions of linear regression. We therefore created a dichotomous variable, deeming that a “Never” response indicates the respondent believes homosexuality to be unacceptable and a response from 2 through 10 to indicates the respondent believes homosexuality to be acceptable in some circumstances. We performed two-level (individuals nested within countries) logistic regression analyses using MLwiN 2.26, estimating parameters using Markov Chain Monte Carlo methods. This gave a goodness of fit diagnostic for each multi-level logistic regression model: the Deviance Information Criterion (DIC). The DIC is an extension of the Akaike Information Criterion (AIC) to multilevel analysis. See Burnham and Anderson (2002) for an introduction to information theoretic goodness of fit criteria which aim to minimize the risk of either overfitting or underfitting one’s data.

We simplified categorical responses to questions about education and religion. Education was collapsed to three categories: none or primary school only; at least some secondary school; at least some tertiary education, with “at least some secondary school” used as the comparison category. We created a dichotomous variable for “importance of religion” (the responses that religion was quite or very important versus responses that religion was of little or no importance or the response “none” to the question about religious denomination). We created five categories from the many categories the dataset provided for responses on religious denomination: None; Muslim; Christian; Other (Eastern); Other (various). “None” was used as the comparison category.

Results

A “null” two-level logistical regression model (a model containing no explanatory variables) estimated a large proportion of the variation (44.5%) to be due to differences at the country-level, i.e. differences between populations rather than individual differences.

The amount of unexplained country-level variance was considerably reduced when variables suggested by each of the three hypotheses were added (see Table 2 and Table S2 for more detailed statistical output). Most of the variables were found to be strong predictors of the response to the homosexuality question. However, being from an English-speaking country or a country with more equal wealth distribution was not found to be associated with higher odds of accepting of homosexuality. In model 4 (the composite model) being Christian or a member of an Eastern religion did not significantly affect acceptance of homosexuality.

	1	2	3	4
	Effect on odds of responding that homosexuality is sometimes justified			
Year survey was performed	1.066	1.079	1.084	1.068
Age	0.982		0.979	0.982
Trust question response is "Trusting"	1.311		1.324	1.314
Religion is important		0.610	0.685	0.847
Religious denomination (compared to "none")				
Muslim		0.445	0.419	0.480
Christian		0.833	0.893	0.977n.s.
Other - Eastern		0.822	0.927n.s.	0.973n.s.
Other - various		0.611	0.633	0.704
Education (compared to "secondary")				
None or primary only	0.840		0.768	0.853
At least some tertiary	1.343		1.473	1.330
Acceptance of divorce (1 to 10)	1.307			1.309
Country-level variables				
Gini index			1.017 n.s.	
GDP/capita (1000 US dollars)			1.091	
TVs/1000 people (1990)		1.005		
Former Soviet		0.524		0.524
English speaking		0.784 n.s.		
Population > 90% Muslim in 1990		0.209		0.340
Years since fertility decline began	1.014			1.014
Unexplained country-level variance	34.3	22.7	27.5	22.1
Goodness of fit (DIC)	71068	79599	77214	70785

Table 2. A comparison of four models suggested as explanations of the pattern of variance in acceptance of homosexuality in 85 countries. Logistic regression gives the effect of variables on the odds of respondent stating that homosexuality is sometimes justified. The four models are: 1 – Kin influence hypothesis; 2 – Exposure to specific information from Western media and religious doctrines; 3 – The materialist-postmaterialist value change thesis; 4 – A model made up of the combination of variables that results in the best fit of the data and explains the most variance. Due to the large sample size almost all relationships are highly significant. Those that are not significant are marked “n.s.”

Two individual-level variables, the respondent’s degree of acceptance of divorce and being of the Muslim faith, had a large effect size in the models in which they were included and the size of the effect was found to vary between different countries. Models in which the effect of these variables was allowed to vary between countries fit the data better (had a lower DIC) and explained more of the country—level variance. Acceptance of divorce was a stronger predictor of acceptance of homosexuality in countries where acceptance of homosexuality was high. The correlation between acceptance of homosexuality and divorce was lowest in the seven countries where over 90 per cent of the population was Muslim.

Of the three explanations (see Table 2), Model 2 (exposure to specific information from Western media and religious doctrines) leaves the least unexplained variance at the country level (22.7%) but Model 1 (the kin influence hypothesis) fits the data best with a DIC of 71068, compared to DICs of over 77000 for the other models. Model 4, which contains the variables suggested by the kin influence hypothesis along with the variables representing importance of religion and religious denomination and the dichotomous variables representing whether or not the respondent’s country had been part of the Soviet bloc and is more than 90% Muslim, provides the best fit to the data (DIC = 70785) and leaves the least unexplained country-level variance (22.1%).

The models based on the three hypotheses each includes a country-level continuous variable which explains a substantial part of the variance. These three variables (years since fertility began to decline, number of TVs/1000 people, and GDP/capita) are highly correlated (see Table 3). Such highly correlated variables likely explain much of the same variance.

	TVs/1000 people	GDP/capita (2002)
Years since fertility decline began	-0.825	-0.608
Number TVs/1000 people (1990)		0.812

Table 3. Correlations between continuous country-level variables.

Discussion

It is not difficult to find patterns of correlation of variables to support ideas about why acceptance of homosexuality varies. But this should not lead us to believe that determining the reason for this variation, or any cultural variation, is an easy problem. Of the four models compared, the one that fits the data best and explained most of the variance is the model made up of variables from more than one of the cultural change hypotheses and most of these variables were suggested by more than one model. This rather complicated result isn’t surprising because culture is complex and cultural change is driven by many different forces (Boyd & Richerson, 1985).

Nevertheless, the analyses provide substantial support for the suggestion that a cultural evolutionary process of continual weakening of family-related norms as described by the kin influence hypothesis is of some importance in explaining the growing acceptance of homosexuality in many populations. The model which best fits the data and explains most variance contained all of the variables which the kin influence hypothesis suggested would be predictors of acceptance. The finding that acceptance of divorce is a strong predictor of acceptance of homosexuality is particularly convincing. Inglehart (2008) notes the correlations

between acceptance of homosexuality and divorce and also acceptance of abortion, extramarital affairs, prostitution and gender equality. He sees them all to be a reflection of increased value placed on autonomy and self-expression but the mechanism he proposes for this change in values (increased security and prosperity) does not explain why it predominantly affects norms that influence behavior of interest to the family (Inglehart & Norris, 2003). Why does the value change not result in people expressing themselves in a wider variety of ways? And why are these values not embraced by elites in countries like Saudi Arabia which have for some years experienced as much prosperity and security as Westerners.

The change in the structure of society that occurs with economic development is profound – as great as, or greater than, the change that occurred with the adoption of agricultural techniques beginning 10,000 years ago. If we accept that this change in the social environment has a longterm effect on the evolution of culture over and above that of the ecological changes that economic development brings, then the amount of time that has passed since the change took place becomes a factor in explaining contemporary cultural variation. Including this new factor must cause us to reassess the importance of other factors which have been considered to be causes of cultural differences in contemporary populations and the rapid cultural changes that most human populations are currently experiencing. As can be seen by comparing Model 3 and 4 in Table 2, a variable that reflects the wealth of the respondent's country is not necessary to achieve a well-fitting model that explains a considerable proportion of the variance in acceptance of homosexuality. As can be seen in Table 3, "years since fertility decline began", the country-level variable which we have used as an estimate for the time of the adoption of family limitation, is strongly correlated with the GDP/capita of the country.

The analyses also support the suggestion that cultural evolution as a result of the introduction of specific information about homosexuality to some populations has some importance as in explaining cultural variation in acceptance of homosexuality. In Model 4, the influence of religion on beliefs about homosexuality was found have an effect through both country-level and individual-level variables. The size of the effects is considerably smaller than in Model 2 and 3, however, and being of a Christian faith or Eastern faith was found to have no effect, a reflection of the wide diversity of belief about homosexuality among those who consider themselves to belong to these religious denominations. Model 4 also suggests an effect associated with living in one of the countries which were part of the Soviet bloc. It is plausible that several decades of separation by an "iron curtain" would have resulted in culture evolving along slightly different tracks in Eastern and Western Europe. It would not be surprising if these differences are still detectable in the years the World Values Survey data used in this analysis was collected (1997-2008).

General Discussion

Western populations are experiencing a rapid rise in acceptance of homosexuality (Andersen & Fetner, 2008a; Scott, 1998). This cultural change is occurring several generations after Western populations experienced the change in the social structure necessitated by economic development economic development but, if the kin influence hypothesis is correct, many contemporary cultural changes, including increase in acceptance of homosexuality, are partly explained by a cultural evolutionary process that was initiated by this change in structure. The two studies reported here support this suggestion. The first supports the assumption that, even

in contemporary Western populations, communication about homosexuality is influenced by fitness considerations; parents are slightly less inclined to influence their children positively about homosexuality. The second shows that the pattern of variation in acceptance of homosexuality in a cross-national sample is most consistent with a model that takes into account the prior emergence of two other beliefs predicted to be associated with the cultural evolutionary process described by the hypothesis – that it is prudent to limit family size and that it is acceptable to divorce.

The second study also supports the suggestion that cultural evolution based on the introduction of specific information about homosexuality plays a role in explaining cultural variation in acceptance of homosexuality.

In spite of this evidential support, it is possible that many social scientists will be reluctant to even consider cultural evolutionary approaches to explaining behavioral change in contemporary Western populations. The kin influence hypothesis proposes that, because the new norms influencing reproductive behavior are emerging from an evolutionarily novel social configuration, much of this behavior is maladaptive. Social scientists who have not been trained in Darwinian thinking may be unaware that “adaptive” and “maladaptive” have specific technical meanings in Darwinian theory. Such scholars may reject this idea because they mistakenly think that considering a behavior to be “maladaptive” is the same as considering it to be inappropriate or unnatural. Social scientists may also be reluctant to consider cultural evolutionary models because their disciplines have a long tradition of looking for explanations of cultural change, particularly modernization, in contemporaneous environmental change (Newson & Richerson, 2009).

If the aim of the social sciences is to achieve a better understanding of human behavior we need to consider different kinds of hypotheses of cultural change. Ecological models make predictions about that are potentially very different from the predictions of evolutionary models. For example, the materialist post-materialist values change thesis implies that a population’s tolerance of minority outgroups will cease to increase after the death of the last cohort to experience scarcity and insecurity and that greater intolerance will emerge if the economic hardship of a population increases (Inglehart, 2008). By contrast, the kin influence hypothesis suggests that, regardless of changes in prosperity and security, populations with the novel social structure created by economic development will continue to progress through this cultural evolutionary process for some generations. It also suggests that the cultural change they experience will not reflect an increased value placed on self-expression; it will reflect a gradual weakening of the norms that encourage individuals to put the interests of their family above their own. This will bring greater tolerance of behaviors such as adultery that threaten the cohesion of the family, but less tolerance of behaviors, such as nepotism, that benefit an individual’s family members at the expense of others.

The process of cultural change described by the kin influence hypothesis will bring changes that many regard as positive, or at least harmless, such as the abandonment of norms which discourage of sexual relationships between people of the same sex. However, the process is also likely to bring changes that are likely to be less positively regarded. Even in Western countries, the maintenance of social order relies on the persistence of values which motivate individuals to take responsibility for members of their family. Ideally, families will strive to raise children that become healthy, competent and law-abiding adults. People will care about relatives who are

incapacitated and make thoughtful decisions on their behalf. If family values weaken to the extent that it becomes acceptable for individuals to neglect these responsibilities, then non-family institutions will be required to take more responsibility for the welfare of those unable to care for themselves.

Most academics studying human behavior live in Western cultures (Henrich et al., 2010). The models of cultural variation we investigate affect, and also reflect, our view of populations which do not share Western beliefs and values. If it is poverty, weak institutions and strong religion that make the moral judgments of a population different from our own then, the cultural gulf between us and them seems vast. But if we are merely at different points on a cultural evolutionary trajectory, the gulf seems bridgeable; we can anticipate that non-Westerners will become more “sexually liberated” in time but that they will take time to evolve these new ideas, just as Western populations did. In societies where the family is a strong social institution, people may be unlikely to be persuaded to adopt Western beliefs about homosexuality but we should be wary of interpreting this rejection as closed-minded “homophobia” akin to racism. In these cultures, even people who experience sexual attraction for members of the same sex may reject the idea that such feelings consign them to a certain sexual category which makes them incapable or unqualified to marry someone of the opposite sex, to raise children, and live what they consider to be a fulfilling life.

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