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Are risk of mortality and morbidity determinants of abortion behaviour and attitudes in England & Wales?

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*I, Sandra Virgo, confirm that the work presented in this thesis is my own.
Where information has been derived from other sources, I confirm that this has
been indicated in the thesis.*

Dedication: To the Evolutionary Demography Group & Rebecca; Jethro; Abi; Charlie; Mara; Margaret; Mel; Susannah; Giorgia; and to my family, who inspired this.

ABSTRACT

There are socioeconomic differentials in abortion attitudes and behaviour in the UK: in more deprived areas individuals and communities are less accepting of abortion; and wards have a lower teenage proportion of conceptions ending in abortion. Evolutionary life history theory predicts that with heightened mortality risk, individuals are disinclined to postpone fertility when young due to following a 'fast' life history strategy, echoed by Geronimus (1999; 1992, 1996a, 1996b; 1999), who suggested in the 'weathering hypothesis' that young women in an environment of heightened morbidity start childbearing at a younger age for similar reasons. Our research investigates whether mortality/morbidity is related to a) likelihood of young women having an abortion and b) young people's abortion attitudes. We use a population-level analysis using small-area geographical data to test for initial associations between mortality (life expectancy) and morbidity (long-term limiting illness prevalence) and proportion of conceptions ending in abortion. We then use two randomised experiments with mortality and morbidity primes to determine if they increase disapproval of abortion, in an attempt to get at causality and psychological mechanisms. Results of the geographical analysis show that with heightened mortality/morbidity, there is lower under-25 'abortion proportion', in line with predictions; whereas poorer local health means higher 'abortion proportion' in older age bands. The experimental results however show no pro-natalist effect of mortality priming on abortion attitudes. Instead it makes women significantly more likely to report they would have an abortion if pregnant now, compared to controls (although this effect is not replicated in the other experiment). Men saw no significant effects on reproductive motivation from treatments. Morbidity Salience had no effect on participants. Despite population-level associations between health and abortion, there either might be other causal pathways from general deprivation to reproductive timing; or the experimental primes had unintended effects.

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Chapter I Introduction:

I.1 Theoretical Framework

The proposed project will investigate socioeconomic differentials in abortion behaviours and attitudes using a Human Behavioural Ecology (HBE) perspective, with particular reference to health inequalities. HBE is an academic discipline using evolutionary theory to examine behavioural and cultural diversity (Hames, 2001). Although much HBE research has taken place in small-scale societies which have not yet encountered the demographic transition, there is an increasing amount of work done in high-income, low fertility populations (Emmott & Mace, 2014; Schaffnit & Sear, 2014), where there is often an apparent departure from reproductive optimality and more can be learned about constraints or tradeoffs feeding into this (Nettle, Gibson, Lawson, & Sear, 2013). Hypotheses in this thesis are derived from life history theory (LHT), which says that over the life-course organisms face tradeoffs in allocating energy between competing functions like growing, learning, mating, reproducing and self-care. LHT further predicts that the optimal balance of these trade-offs to maximise reproductive fitness will depend on the local ecology (Schaffer, 1983).

James S Chisholm et al. (1993) were among the first to give a clear theoretical rationale for why extrinsic mortality should influence reproductive scheduling and other reproductive traits, in their work emphasising the possible role of early exposure to bereavement on the rest of the life-course. Probable lifespan varies between ecologies, and is an overarching parameter setting the time horizon of energetic allocation. As indicated by S C Stearns (1992), 'extrinsic' mortality and morbidity are not the result of individuals' actions or those of their parents, and therefore cannot be controlled by them. This makes them important in limiting

energetic allocation to each respective life-history function and influencing the prioritisation of each by organisms, and therefore individual behaviour.

Mortality and morbidity curtail ability to conceive, bear and care for offspring (Geronimus et al., 1999). Indicators of a high mortality environment may mean 'faster' life histories, typified by (among other things) earlier age at first reproduction and shorter lifespan. 'Slower' life histories occur in low mortality/less risky environments (Charnov, 1991). Life histories can diverge between species (Promislow & Harvey, 1990) and within species (Reznick, Bryga, & Endler, 1990); and are not necessarily governed by conscious decision-making (Engqvist & Sauer, 2002; Javois & Tammaru, 2004). Across 22 small-scale human societies, high mortality rates were associated with earlier age at menarche and earlier reproduction (Walker et al., 2006). Such adaptations can happen over evolutionary time (Migliano, Vinicius, & Lahr, 2007); or within a lifespan environmental cues can influence an organism's phenotype via evolved adaptive mechanisms. Within human lifespans such effects may occur via physiological and psychological mechanisms (Del Giudice & Belsky, 2011; Nettle, 2010b). As long as individuals are receiving enough calories to be fertile, mortality is therefore expected to influence reproductive scheduling (Ellis, Figueredo, Brumbach, & Schlomer, 2009), whereby high mortality is related to earlier reproduction. Another outlook which echoes this life history theory perspective is that of the 'weathering hypothesis' (Burton, 1990; Geronimus, 1992, 1996a, 1996b), whose proponents say that individuals with higher mortality and morbidity risk may schedule fertility earlier to mitigate reproductive costs, even though this can come with other opportunity costs e.g. for humans, the chance to accrue education and resources.

1.2 Interdisciplinary Research

The research inside this thesis is conducted as an interdisciplinary project, as it will be testing HBE hypotheses derived from life history theory, but will be using demographic methods to test associations between environment and reproductive decision-making; and psychological methods to test whether any any associations between environment and behaviour seem to follow a causal pathway via systematic evolved psychological mechanisms. This means that the thesis draws on literature from both demography/epidemiology and psychology to inspire its research methods.

1.3 Empirical links between mortality and fertility

Demographers have long suggested causal links between mortality and fertility (Ni Bhrolchain & Dyson, 2007). Changes in one are often matched by changes in the other, and fertility decline during demographic transition (Caldwell, 1976) has sometimes been conceptualised as a 'response' to declining mortality (Cleland, 2001).

Mortality (and associated morbidity)'s relationship to fertility quantum (i.e. the number of children had by individuals/populations) is seen after fatal disasters (Cohan & Cole, 2002; Heuveline & Poch, 2007; K. Hill & Hurtado, 1996; Rodgers, Craig, & Coleman, 2005); in relation to national disease diversity (Guegan, Thomas, Hochberg, De Meus, & Renaud, 2001) and within families (Bereczkei & Csanaky, 2001). Fertility timing is associated with mortality and morbidity at individual and family level controlling for income, education and ethnicity (Burton, 1990; J S Chisholm, Quinlavan, Petersen, & Coall, 2005; Geronimus, 1996b); at population level controlling for education and income (Geronimus et al., 1999; B S Low, Hazel, Parker, & Welch, 2008; Nettle, 2010a; Pickett, Mookherjee, & Wilkinson, 2005; M. Wilson & Daly, 1997); and chronic childhood illness predicts earlier age at first birth (Waynforth, 2012). Some research finds women consciously associating their

expected healthy lifespan to reproductive timing (Geronimus, 1996b; E. M. Hill, Ross, & Low, 1997). Experimental evidence also exists of unconscious psychological mechanisms converting mortality awareness to reproductive motivation (Fritsche et al., 2007; Griskevicius, Delton, Robertson, & Tybur, 2011; Mathews & Sear, 2008; Wisman & Goldenberg, 2005; Zhou, Lei, Marley, & Chen, 2009; Zhou, Liu, Chen, & Yu, 2008).

1.4 Socioeconomic variation within societies

Life history theory is a framework which can be used to understand socioeconomic variation in reproductive behaviour. This is because there is socioeconomic variation in access to key environmental risks such as mortality as well as mortality. Typically, within developed societies, poorer people have children earlier (Imamura et al., 2007; Joshi, Hawkes, & Ward, 2004). Health inequalities mean poorer people are more exposed to extrinsic morbidity and mortality hazards. Accidental death or homicide and heart disease are more likely in poorer neighbourhoods, independent of individual-level factors (Cubbin, LeClere, & Smith, 2000; G. D. Smith, Hart, Watt, Hole, & Hawthorne, 1998). Those in deprived areas are exposed to more air pollution (Bolte, Tamburlini, & Kohlhuber, 2010). Early-life factors also show socioeconomic differences (Poulton et al., 2002; Power & Matthews, 1997), affect health prospects, and cannot easily be mitigated by the adult individual (Barker, 1998; Gluckman, Hanson, & Beedle, 2007). Those in the most deprived neighbourhoods had a more than 2.5-fold increase in mortality risk when compared to those from the least deprived areas in one UK study (Romeri, Baker, & Griffiths, 2006). Controlling for health behaviours does not eliminate the socioeconomic health gradient (Lantz et al., 1998; Soskolne & Manor, 2009). In low-mortality environments, which are prevalent in developed nations since the start of the epidemiological transition (Olshansky &

Ault, 1986), morbidity has increased as mortality rates have dropped, and it can have sharper socioeconomic differentials (Bajekal, 2005). Therefore it is possible that in such societies the morbidity of the individual and his/her allies are even more pertinent than life expectancy in determining individuals' health.

There can be educational and career benefits to delaying childbearing, but those at greater risk of mortality/morbidity may be less able to make these investments, despite potential long-term benefits to children (Bulled & Sosis, 2010; Geronimus, 1996b; H Kaplan, Hill, Lancaster, & Hurtado, 2000; Krupp, 2012; B S Low et al., 2008; Nettle, 2010b; Nguyen et al., 2012). Subjective life expectancy is positively related to socioeconomic status and negatively to physical impairment (Mirowsky & Ross, 2000; Wardle & Steptoe, 2003), and may predict reproductive outcomes related to environmental quality and/or maternal condition (Johns, 2004). As poorer families disperse less for economic opportunities (Murphy, 2008; Sear & Dickins, 2010), childcare is more likely to be undertaken by family (Kramer & Lancaster, 2010), although relatives may see early functional limitation and mortality (Bajekal, 2005; Geronimus et al., 1999). Early fertility may allow families to mitigate such costs (Nettle, 2010a).

1.5 Abortion and Fertility Postponement

As abortion is a proximate determinant of fertility (Bongaarts, 1978) it may mediate links between mortality and fertility's quantum and tempo. It is commonly used all over the world, with 2008 estimates of 24 (developed world) to 29 (developing world) abortions per 1000 women of reproductive age (Sedgh et al., 2012). Despite its common use to regulate fertility, LHT research linking mortality/morbidity risk to abortion, rather than other reproductive outcomes, is fairly uncommon and this might be due to the difficulties of acquiring data at anything other than large aggregate

level due to the sensitivity of the subject and confidentiality issues. Indeed, Krupp (2012) found in Canada, life expectancy positively predicted abortion rate for under-15s and the over-40s, controlling at provincial level for median household income and at health region level for annual personal income, but these regions contain tens of thousands of inhabitants. Although abortion can be used to limit family size for the older women, for younger women it is more often used to postpone reproduction to wait for more auspicious circumstances like a secure partnership or increased economic resources (Lycett & Dunbar, 1999). But for those exposed to heightened mortality and morbidity risk as well as decreased educational and economic opportunities, this may be a risky strategy. Investigating abortion, therefore, might help strengthen LHT research on the mortality-reproduction link.

In the UK, more deprived individuals and communities have both lower levels of abortion (controlling for conceptions), and show less acceptance of it (Lee, Clements, Ingham, & Stone, 2004).

The question posed in this research project is:

Are risk of mortality and morbidity determinants of abortion behaviour and attitudes in England & Wales?

It is possible that the socioeconomic differentials we see in the acceptance of abortion might at least partially driven by differentials in mortality and morbidity, which in turn might influence uptake of educational opportunities in young women, as there are time trade-offs between education and childrearing. The interest in such socioeconomic differentials guides this research, and as a first pass we test for these rudimentary links between health and reproductive outcomes.

1.6 Research on abortion and deprivation

Research on links between abortion and socioeconomic deprivation mostly comes from policymakers' interest in teenage pregnancy, and is reviewed next. Deprivation is multidimensional, comprising correlated phenomena e.g. housing tenure, occupational status, income, access to services, etc. Selection of deprivation measures should ideally be guided by empirical and theoretical considerations (Braveman et al., 2005; Davies, Joshi, & Clarke, 1997). We will see that in abortion research health deprivation has been largely ignored.

1.6.1 Quantitative Area-level Research

At area level socioeconomic abortion differentials are measured by 'abortion proportion' i.e. the proportion of conceptions ending in abortion, hereafter AP). Areas with a high teenage conception rate typically have a low AP, as deprivation accounts for most area-level variation in both (Bradshaw, Finch, & Miles, 2005; Garlick, Ineichen, & Hudson, 1993). Some research has used composite deprivation measures (McLeod, 2001) like Carstairs scores (Carstairs & Morris, 1991), while others (Diamond, Clements, Stone, & Ingham, 1999) have disaggregated indices into standardised components.

Table 1.1 summarises descriptive and correlational studies and recurring relationships found between deprivation and low AP. Table 1.2 shows multivariate models, including in the fifth column deprivation predictors not retaining significance.

Table 1.1: Descriptive and correlational area-level relationships between socioeconomic/demographic variables and abortion proportion 'AP'

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Wilson et al. (1992)	11-19	England Regional Health Authorities (14) 1989	↓ AP = Northern England ↑ AP = Thames regions ↓ AP = ↑ Female all-cause Standardised Mortality Ratio (SMR)	NHS abortion service availability	Yes: Northern England has lower AP, while Thames regions have higher. Higher Standardised Mortality Ratio (SMR) means lower AP. (SMR here acts as proxy for socioeconomic status more generally.)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Smith (1993)	<20 (age at birth/termination)	Tayside, Scotland Postcode sectors (70) WITHIN local authority districts (3) 1980-1990	<u>Carstairs deprivation septiles:</u> (male unemployment; social class; car ownership; overcrowding) <u>Postcode sectors:</u> ↓ AP = ↑ deprivation Most deprived: AP = 26% Least deprived: AP = 63% <u>Local authorities:</u> ↓ AP = ↑ deprivation	Geographical proximity to abortion facilities.	Yes: more deprived postcode sectors and local authorities have lower AP. (Geographical mobility is not a confound, as most individuals had resided in similarly deprived areas long-term.) (NHS abortions only, so ability to pay not a confound.)
(Garlick et al., 1993)	16-19	District Health Authorities (16) within North-East Thames Regional Health Authority 1990	<u>Jarman Underprivileged Area Score (from 1981 census data):</u> Live Birth Rate minus Abortion Rate Index (LBR-AR): good (exact magnitude unreported) correlation with UPA score, so that the more maternities relative to abortions, the higher the UPA score.		Yes: The higher the maternities relative to abortion, the higher the Underprivileged Area Score. (‘AP’ not used here. Instead Live Birth Rate minus Abortion Rate (LBR-AR) Index used, which gives the relative prevalence of maternity to abortion.)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Wood (1996)	15-44	England & Wales District Health Authorities (112 England; 9 Wales) 1993 and 1983-1993 change (see main document for summary of the latter).	ONS area classifications 1991: 1993: ↑ AP = Inner London; Services & Education; Most prosperous ↓ AP = Manufacturing		Yes, although difficult to entirely map deprivation onto area classifications. Declining areas based on manufacturing saw lower AP; while those in Inner London, with service industry and the most prosperous areas saw higher AP. (Inner London & Services & Education (comprising much of Outer London) also ↑ conception rates, and thus are unusual for richer areas.) This study unusually looked at all age groups.

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Griffiths & Kirby (2000)	<18	England, Scotland, Wales Government Office Regions (9) Local Authorities (487) 1992-1997	<u>Local Authorities in ONS area classifications 1999:</u> ↑ AP = Growth Areas, Most Prosperous, Rural Amenity, Remoter Rural ↑ AP (and ↑ conception rates) = West Inner London, East Inner London ↓ AP = Coalfields, Manufacturing Centres, Ports & Industry, Established Service Centres <u>Countries:</u> ↑ AP = England <u>Regions:</u> ↑ AP = London; Southern regions ↓ AP = Northern regions <u>Local Authorities:</u> ↑ AP = Inner London		Yes, although difficult to map area classifications fully onto deprivation. England, the most prosperous of the three countries, had higher AP. Broadly speaking, areas in economic decline had lower AP (Northern regions; Coalfields), and those with more money had higher AP (e.g. Inner London, Growth Areas).

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Wilkinson (2006)	<18	England Top-tier local authorities (148) Change over time between 1994-8 AND 1999-2003	<u>Quartiles of deprivation (population-weighted averages of Indices of Multiple Deprivation – IMD – for Lower Super Output Areas):</u> ↑ AP over time in all deprivation quartiles Increase in APs over time was associated with (by quartile): ↑ IMD scores ↑ unemployment rate for women aged 16-19 ↓ % of 16-year-olds achieving grades A-C in 5 or more GCSE subjects ↑ contraceptive access		
Uren et al. (2007)	<18	England & Wales Electoral wards 2001-2002	<u>2001 Carstairs deprivation deciles/quintiles:</u> (unemployment; social class; car ownership; overcrowding) ↑ AP = ↓ deprivation (both <18 and <16; gradient steeper for <16) Exception: London wards, where ↑ deprivation = ↑ AP ↑ AP = southern English regions (contrasted with northern England).		Yes, but inverse linear relationship only present across all deprivation deciles if London is excluded. Deprived wards in London = ↑ AP (London as exception in having both ↑ AP and ↑ conception rate)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION GEOGRAPHICAL UNIT (N) TIME PERIOD STUDIED	SOCIOECONOMIC/DEMOGRAPHIC VARIABLES USED AND RELATIONSHIP TO ABORTION PROPORTION	NO RELATIONSHIP WITH AP	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Conrad (2012)	15-17	England – Local Authorities (354 before 2009; 326 after) 1998-2010	<u>Indices of Multiple Deprivation 2000; 2004; 2007; 2010</u> ↑ AP = ↓ deprivation		Yes, but the negative correlation decreased in size from 1998 (r= -0.501) to 2010 (r= -0.332). Decrease was statistically significant. (IMD scores significantly correlated with percentage change in AP from 1998 to 2010, indicating that increase in AP was disproportionately in the more deprived areas.)

Table 1.2: multivariate studies of relationships between socioeconomic variables and 'abortion proportion' (AP)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION UNIT OF GEOGRAPHICAL ANALYSIS (N) TIME PERIOD STUDIED	SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS OF CONCEPTION OUTCOME DV USED IF NOT 'ABORTION PROPORTION' SIGNIFICANCE LEVEL USED.	NON-SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Diamond et al. (1999)	<20	South and West England (Wessex Region) Census wards (589) WITHIN District Health Authorities (6) 1991-1994	Standardised components from Jarman, Townsend, DoE and Carstairs deprivation indices. DV is odds of maternity <u>Urban areas:</u> One-SD increase in ward's non-car-ownership = 50% increase in maternity odds. p < 0.001 One-SD increase in under-5 population = 24% increase in maternity odds. One-SD increase in both the above = 86% increase in maternity odds. ↑ proportion of students = ↑ chance of conceptions being terminated (NOT for 16/17-year olds) <u>Rural areas:</u> One-SD increase in non-car-ownership more than doubles odds of maternity P<0.05 Increase of one point in under-5 population increases odds of maternity by 22% <u>District Health Authorities:</u>	Standardised components from Jarman, Townsend, DoE and Carstairs deprivation indices. <u>Urban areas:</u> Unemployment Low social class Unskilled Overcrowding Not owner-occupied Lacking amenities Single parents Lone pensioners Immigrants Ethnic minorities Children in low-earning households Children in unsuitable accommodation Educational participation at age 17 Distance to youth-oriented family planning clinic OR any contraceptive supply service <u>Rural areas:</u> Same as for urban areas	Yes, but only for certain measures of deprivation. Here an alternative DV is odds of maternity: Non-car-ownership related to higher maternity. Higher proportion of students in an area means terminations more likely (though presence of students could either relate to proximity of a university or to more schoolchildren staying on to do A-levels, and it is also only true for terminations in 18- and 19-year-olds) (Effect of District Health Authority might reflect policy in termination availability e.g. if they contract out to BPAS and so people need to travel further)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION UNIT OF GEOGRAPHICAL ANALYSIS (N) TIME PERIOD STUDIED	SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS OF CONCEPTION OUTCOME DV USED IF NOT 'ABORTION PROPORTION' SIGNIFICANCE LEVEL USED.	NON-SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
			↑ odds of conception ending in maternity in Southampton, Wiltshire and Isle of Wight (ref.: Dorset) for <16s.		
McLeod (2001)	13-15, 16-17, 18-19	Scotland Postcode sectors 1981-5 1991-5 NHS records only (but NHS carried out 89.2% abortions in 1983 and 95% in 1993)	DV is proportion resulting in maternity (MP), separate for married/unmarried teens. <u>Carstairs deprivation quartiles:</u> ↑ MP ↑ deprivation <u>Urban/rural:</u> ↓ MP = urban 18-19-year-olds	<u>After adjusting for deprivation and marital status:</u> Urban/rural (apart from urban 18-19-year-olds)	Yes, the more deprivation the higher the maternity proportion. However, there is a lower maternity proportion in urban (as opposed to rural) 18-19-year olds, which remains present after controlling for deprivation.

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION UNIT OF GEOGRAPHICAL ANALYSIS (N) TIME PERIOD STUDIED	SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS OF CONCEPTION OUTCOME DV USED IF NOT 'ABORTION PROPORTION' SIGNIFICANCE LEVEL USED.	NON-SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Lee et al. (2004) PHASE ONE	<18	Great Britain Local Authorities (352 England, 22 Wales, 32 Scotland) 1997-1999	p<0.01 <u>FINAL MODEL <18 AP:</u> ↓ AP = ↑ % 11-15-year-olds dependent on Family Credit claimants ONS area classification: ↑ AP <i>Coast and Services, Urban Fringe, Rural Areas, Prosperous England (ref. Mining, Manufacturing & Industry)</i> ↓ AP = Presence of a BPAS consultation centre (after initial referral by doctor, this is where the woman discusses her decision with the abortion provider prior to any procedure) ↑ AP = ↑ all-age AP (the latter reduces the effect of the above service-related factor)	<u>After accounting for deprivation, service provision and all-age abortion proportion:</u> Ethnicity % <18 abortions performed by NHS BPAS abortion clinic provision	Yes, in that there was a lower AP in local authorities where there was a higher percentage of 11-15-year-olds dependent on Family Credit claimants. FC was a social security benefit for the working poor. All area classifications had higher AP than Mining, Manufacturing and Industry areas, which were in economic decline. (Significant Local Authority variance still unexplained – this could be down to ecological fallacy or other unmeasured factors.)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION UNIT OF GEOGRAPHICAL ANALYSIS (N) TIME PERIOD STUDIED	SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS OF CONCEPTION OUTCOME DV USED IF NOT 'ABORTION PROPORTION' SIGNIFICANCE LEVEL USED.	NON-SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Lee et al. (2004) PHASE TWO	16-17 <16	18,293 conceptions WITHIN 1,412 census (1991) wards WITHIN 21 Local Authorities (18 England and Wales; 3 Scotland) randomly selected within ranges of conception rates and APs. MULTILEVEL LOGISTIC REGRESSION	p < 0.01 <u>FINAL MODEL 16-17 AP:</u> ↓ AP = ↑ % economically active population unemployed ↓ AP = ↑ % 17-year-olds not in FT education ↓ AP = ↑ % 11-15-year-olds dependent on Family Credit claimants ↓ AP = ↑ % Residents aged <5 ↑ AP = ↑ % African-Caribbean females. ↑ AP = ↑ all-age AP (at LA level) <u>FINAL MODEL <16 AP:</u> ↓ AP = ↑ % economically active population unemployed ↑ AP = ↑ all-age AP (at LA level)	<u>After accounting for deprivation, service provision, and all-age abortion proportion:</u> Rural/urban All service (referral, consultation and procedure) provision indicators at both ward and LA level	Yes, as the following meant lower AP in 16-17-year-olds: Higher unemployment; more 17-year-olds not in full-time education; more 11-15-year-olds dependent on Family Credit claimants. Lower AP in under 16s where there were more unemployed. (Association with Afro-Caribbean ethnicity could relate to lower sample sizes of other ethnic groups.)

AUTHOR AND YEAR OF PUBLICATION	AGE GROUP STUDIED	LOCATION UNIT OF GEOGRAPHICAL ANALYSIS (N) TIME PERIOD STUDIED	SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS OF CONCEPTION OUTCOME DV USED IF NOT 'ABORTION PROPORTION' SIGNIFICANCE LEVEL USED.	NON-SIGNIFICANT AREA-LEVEL SOCIOECONOMIC PREDICTORS	IS DEPRIVATION INVERSELY RELATED TO AP? (OTHER NOTES)
Bradshaw et al. (2005)	15-17	England – Local Authorities (352) 1994-6 AND 1997-9	<u>Dept of Environment, Transport and Regions Deprivation Index</u> p <0.001 FINAL MODEL BOTH TIME PERIODS: ↑ deprivation ↓ AP Health deprivation and disability ↑ deprivation ↑ AP Employment deprivation (NB See notes in final column) ↑ % ethnic minorities ↑ AP EARLIER TIME PERIOD ONLY: ↑ deprivation ↑ AP Geographical access to services (i.e. post office, food shops, GP, primary school)	In final model, non-significant predictors (p<0.001) Income Child Poverty Index Education, skills and training Housing	Yes: higher health deprivation meant lower AP. Higher employment deprivation meant lower AP. In earlier time period, poorer access to services meant lower AP. About three quarters of the variation in the AP can be explained by models with all deprivation variables and ethnicity. These factors also explained 69% of change between two time periods. Service provision and/or unmeasured socioeconomic factors could explain the rest of the change. Employment deprivation had a negative relationship with AP in correlation matrix. When all the other deprivation measures were added to the regression, the coefficient of employment deprivation was positive due to collinearity and suppressor effects.

1.6.2 Area-level analyses and health

Tables 1.1 and 1.2 show deprivation most strongly predicts low AP, across the studies, compared to other variables used like ethnicity or service provision. Because there is a wide variety of different methods and measurements used for both deprivation and abortion, a quick summary presents challenges. However, broadly speaking, large areas of economic decline experience (e.g. the North of England; manufacturing areas) lower abortion relative to maternities compared to more prosperous areas and areas of economic growth. Composite measures of deprivation for wards show the inverse relationship between abortion and deprivation. A lack of car ownership in an area also seems to predict lower abortion levels, as does the percentage of 11-15-year-olds dependent on Family Credit claimants (i.e. the working poor); and the proportion of the working-age population unemployed. A possible exception to this inverse relationship between deprivation and abortion might be London, where Uren, Sheers, and Dattani (2007) find that deprived wards have a higher AP, suggesting that economic opportunity could complicate matters (particularly as Wood (1996) and S. H. Wilson, Brown, and Richards (1992) found that London areas have both high conceptions and high abortion, whereas rich areas usually have low conceptions coupled with high abortion). The inverse relationship between deprivation and AP could also be in decline in more recent years (Conrad, 2012).

However, many multivariate models using standardised components of existing composite deprivation indices (Diamond, et al., 1999; Lee, et al., 2004) include no health measures. Although Wilson et al. (1992) find area-level associations with Standardised Mortality Ratio, it is merely a standalone proxy for all deprivation. The only multivariate research measuring health (Bradshaw, et al., 2005) finds 'health deprivation and disability' retaining significance where other deprivation measures like income, housing, child

poverty and education, skills and training do not (see note in Table One regarding employment deprivation).

1.6.3 Service provision

Proximity and availability of contraceptive and abortion services are much less strongly related to APs than is deprivation. Neither is the balance of NHS versus independently provided abortion services influential (Diamond, et al., 1999; T. Smith, 1993; S. H. Wilson, et al., 1992). The most sophisticated study (Lee, et al., 2004) finds net of deprivation, local authorities with a British Pregnancy Advice Service clinic have higher under-18 APs; with lower under-18 APs where there are BPAS consultation centres alone, but this may reflect targeted placement of services.

1.6.4 Individual-level quantitative research

Area-level research often commits the 'ecological fallacy' (Piantadosi, Byar, & Green, 1988), the presumption of identical patterns at individual level as those observed for aggregates. Unfortunately the sensitive and confidential nature of abortion data means individual-level quantitative data are both rarely available and seldom linked to area-level data. However, some questionnaire and survey research has found links between abortion and higher educational attainment (Lo, Kaul, Kaul, Cooling, & Calvert, 1994; Wellings, Wadsworth, Johnson, Field, & Macdowell, 1999), although the causal direction between motherhood and reduced attainment is disputed. Smith and Roberts (2009) found net of area-level ethnicity, abortion acceptance was associated with residence in more affluent London boroughs. Investigating individual-level ethnicity showed black residents tended to be opposed to abortion; but for Asians and whites, opposition was mostly confounded by area-level deprivation. Individual-level socioeconomic controls were impossible as many respondents were uncategorisable by ONS groups (as mothers or full-time students).

APs across District Health Authorities are least similar for < 25 age groups and most similar for ages 25-34 (Wood, 1996), suggesting socioeconomic divergence related to educational divergence. The positive association between longer educational enrolment and AP or abortion approval (Diamond, et al., 1999; Lee, et al., 2004; Lo, et al., 1994) suggests fertility postponement for educational opportunities.

1.6.5 Building on previous quantitative research

As we can see from Tables One and Two, deprivation is negatively related to AP. However, in many of the analyses, deprivation is only measured with a univariate composite index such as the Carstairs (T. Smith, 1993) the Jarman Underprivileged Area Score (Garlick et al., 1993) or the Indices of Multiple Deprivation (Conrad, 2012; Wilkinson et al., 2006), meaning that it is hard to tease out which elements of deprivation are especially salient in this relationship. This means that not only are relationships between health and AP rarely specifically investigated, but it is not possible to have controls which measure different aspects of deprivation. The research in the current thesis uses several disaggregated measures of deprivation including not just health inequalities but those related to education, housing tenure and unemployment to do this.

There are also few existing studies which have actually used any standalone measures of mortality or morbidity and their relationship with AP. Of the studies which have done so, there were further limitations, despite their finding the general negative relationship that life history theory would predict. Although S. H. Wilson et al. (1992) used female all-cause Standardised Mortality Ratio and found a negative relationship between this and AP, the measure acted as a general proxy for deprivation and there were no control variables. Bradshaw et al. (2005) in their multivariate analysis did find that 'health deprivation and disability' was inversely related to AP in their final models for both time

periods investigated. However, they were only able to use English local authorities as their geographical unit, an area whose mean population size in mid-2014 was estimated to be 244, 356 (ONS, 2015). A Canadian study (Krupp, 2012) which used the framework of life history theory found that life expectancy did have a positive relationship with the abortion rate for both under-15s and over-40s, controlling for median household income at provincial level and for annual personal income at health region level. However, again, these geographical areas are large and heterogeneous, provinces having an estimated mean population of 3,542,370 in 2014 (Statistics-Canada, 2014) and health regions containing tens of thousands of people. The problem with the use of such large units is that in terms of deprivation they are likely to be very varied, so measures are unlikely to be adequately representative of the area. Additionally, research based on life history theory assumes that the individual is affected by its ecology via 'local cues' which it must be picking up via some aspect of its sensory system (not necessarily consciously). The sensory system is only likely to be able to pick up information from a small proximate area. An extra issue which has been much discussed is the ecological fallacy (Piantadosi, Byar, & Green, 1988), the misguided assumption that relationships which hold at the area level are the same at individual level. Although abortion data are rarely available at individual level due to confidentiality concerns, one way of mitigating the ecological fallacy is to have the data at as small a geographical level as possible (Lancaster, Green, & Lane, 2006). The research described in Chapter Two has been able to do this, using electoral wards which have a mean population size of fewer than 6,000. Opportunely, the number of wards in England and Wales available for analysis also tops eight thousand, a considerably larger sample size than in previous work, with the exception of Uren et al. (2007).

The other limitation to previous work which the geographical analysis in Chapter Two can address is that it is overwhelmingly orientated towards abortion in the youngest women, thanks to the preoccupation of UK policymakers for many years with teenage pregnancy. The research in the current thesis not only looks at abortion's relationship to small-area level mortality and morbidity in under-25s, but also in age bands 25-29, 30-34 and 35 and over. Although hypotheses will only specifically relate to the youngest age band as life history theory chiefly makes predictions about the commencement of reproduction, exploratory work for the other age bands will be undertaken. Although Krupp (2012) investigates age-specific fertility across the age bands and its relationship to life expectancy, his age bands for abortion rate (number of abortions/1000 same-aged females) are limited to just the under-15s and the over-40s, arguably both unusual age bands if one is interested in the full reproductive period as it is in those age bands that abortion is highest (Lycett & Dunbar, 1999).

1.6.6 Previous qualitative research: attempting to understand reproductive motivation

Qualitative research investigates people's own understandings of abortion using discussion with socioeconomically varied individuals and communities. Although it cannot necessarily tap into unconscious influences on people's behaviour, it can get at social norms influencing people, as these often come into play during focus groups, and it can elucidate potential mechanisms mediating associations occurring at group or area-level. Table 1.3 summarises this work.

Table 1.3: Summary of qualitative research into socioeconomic disparities in abortion behaviours and attitudes

AUTHORS AND YEAR OF PUBLICATION	LOCATION; CASE SELECTION; AGE GROUP; METHOD	PRINCIPAL THEMES IDENTIFIED
Burghes (1999)	31 'teenage' never-married mothers in Doncaster, Fareham, London, Manchester & Plymouth. Maternity group contrasted with never-pregnant group of 8 rather than individuals choosing termination. Individual interviews.	Maternity: Limited education and employment prospects (not expressed consciously) Moral opposition to abortion (expressed consciously): woman as sexually irresponsible. Local community opposed more to abortion than to early parenthood. Childminding support offered by woman's mother. Quick decision in line with social norms. Occasionally woman's mother suggested termination.
Jewell, Tacchi & Donovan (2000)	34 women aged 16-20: including one group young mothers/pregnant and a never-pregnant group, rather than those who had chosen termination. Sampled from advantaged and disadvantaged areas via young mothers' groups, GP surgeries, youth sexual health clinics, and snowballing. Individual interviews and participant observation. Bristol, England. Researchers were unable to find any socioeconomically advantaged pregnant teens, so compared advantaged and disadvantaged women.	Less advantaged group: More likely to be pregnant/mothers. Abortion less acceptable. More difficulties getting access to reliable contraceptive services. Less likely to use emergency contraception. Could not find 'good enough reason' for abortion. Earlier ideal age at parenthood (17-25) Advantaged group: More willing to use abortion Emphasis on career, university, money and personal development Later ideal age for parenthood (late 20s-early 30s)

AUTHORS AND YEAR OF PUBLICATION	LOCATION; CASE SELECTION; AGE GROUP; METHOD	PRINCIPAL THEMES IDENTIFIED
Tabberer et al. (2000)	Doncaster, England (high teenage conception rate). Individual interviews with young women who had been or were pregnant; focus groups with non-pregnant young women; focus groups with young men who were mostly not fathers; individual interviews with parents of non-pregnant teenagers	<p>Pregnant young women: More anti-abortion than those who had already had a child Moral opposition to abortion: important for woman to be responsible and not take a life.</p> <p>Young mothers: More likely to consider termination for subsequent pregnancies (welfare of current child and own ability to cope mentioned) Boyfriends sometimes peripheral to decision if weak relationship or if parental support already secured</p> <p>Those who had had abortions: Initially reluctant to consider termination More likely to have already left school (post-school life harder to sacrifice for a child)</p> <p>Young men: Anti-abortion (exceptions were one-night stands or if woman would make a poor mother) Often happy to let woman and her parents decide</p> <p>Community: Local 'cultures' regarding the impact of a birth Scant evidence of communities discussing abortion prior to pregnancy Early maturity – parenting complete by mid-20s</p> <p>Influences on decision: Absence of impartial/concrete information Decision often derived from existing views, plus support of those views and known experiences of those nearby. Women aware of immediate family's views on abortion Unconditional parental support often implicitly influenced continuation to motherhood</p>

AUTHORS AND YEAR OF PUBLICATION	LOCATION; CASE SELECTION; AGE GROUP; METHOD	PRINCIPAL THEMES IDENTIFIED
Thomson (2000)	UK Young people Affluent commuter belt town & deprived public housing estate Questionnaires, focus groups, individual interviews	<p>Working-class: Less approving of abortion than middle-class (no gender split) More physical capital (e.g. male violence; teen parenthood)</p> <p>Middle-class: Tolerant and pragmatic re: abortion (no gender split) Need to be able to support a child before having one Rejected immediate gratification More social and cultural capital exchangeable outside local area</p>
Turner (2004)	East/Central Scotland Questionnaires & discussion groups 15-year-old students One private school (N = 85); two local authority schools (N = 74; 85)	<p>Private school: Reported more likely to choose abortion if pregnant within next month Less likely to consider teen motherhood Less likely to know a teen mother Greater perceived opportunity costs to pregnancy Parents perceived to be more likely to advocate abortion</p> <p>Local authority schools: Teen motherhood not viewed positively: rather, abortion viewed negatively</p> <p>Questionnaire results: Individual's predicted outcome to pregnancy associated with predicted emotion on becoming pregnant and her view of abortion</p>
AUTHORS AND YEAR OF PUBLICATION	LOCATION; CASE SELECTION; AGE GROUP; METHOD	PRINCIPAL THEMES IDENTIFIED

<p>Lee et al. (2004)</p>	<p>50 young women who had terminated pregnancies</p> <p>50 young women who had chosen motherhood</p>	<p>'Foetus-centred' versus 'woman-centred' views of abortion: F-C predominated. One quarter of those terminating held W-C views. Those with 'W-C' views influenced by specific experiences, and included mothers Rare for women to hold 'W-C' view in its abstract form</p> <p>Influences on views: Prior to pregnancy, many held no opinions on abortion Attitudes not stable: some changed their minds upon having an abortion or on having a child (both becoming more W-C) Abortion as practical solution in certain contexts (e.g. unemployment) Perception of woman's future life shapes decision, and is influenced by advantage/disadvantage</p> <p>Pro-life mothers: Backgrounds of unstable employment, and other instability: motherhood as escape route from this</p> <p>Mothers: More than twice as many said having a baby before age 25 was desirable than did those who terminated - did not want to be an 'old mum' Fitted 'education' and 'job' around the central role of motherhood Often enjoyed being a mother and did not feel they'd missed out</p> <p>Those who terminated: Preferred age at first birth 30 and over Motherhood would disrupt 'university' or 'career' plans Those seeing motherhood as central but who terminated: Based decision to terminate on current situation e.g. unemployment Found decision more difficult Described decision re: current ability to take care of child rather than own future plans</p> <p>Conditions of acceptability of abortion: Acceptable only if conception out of control e.g. rape Woman deemed 'responsible' for continuing to motherhood in other circumstances Fewer than half believed abortion should occur merely out of woman's preference</p>

AUTHORS AND YEAR OF PUBLICATION	LOCATION; CASE SELECTION; AGE GROUP; METHOD	PRINCIPAL THEMES IDENTIFIED
Arai (2007)	15 women who had given birth before age 21	<p>No-one reported that decision to continue to motherhood was affected by friends or others, despite the fact these people had been asked for advice.</p> <p>Anti-abortion sentiment and beliefs</p> <p>Desire to have a baby</p> <p>Those in Northern regions knew more teenage mothers than Londoners did.</p>
Hoggart (2012)	34 female teenagers, comprising teenage mothers and those who had had an abortion. NB some had experienced both.	<p>Mothers:</p> <p>View of abortion as a way of avoiding the responsibility of parenthood, having taken the risk of unprotected sex. Motherhood as moral redemption.</p> <p>Shared values with family</p> <p>Moral undesirability of abortion</p> <p>Feeling of being 'ready' to have a child</p> <p>Ambivalence related to conflicting values</p> <p>Those who had abortions:</p> <p>'Not being ready' to raise a child due to educational interests: responsibility here is pragmatism of abortion.</p> <p>Shared values with family</p> <p>Sense of relief after abortion</p> <p>Feeling of not being 'ready' to have a child</p> <p>Some participants regretted abortion, seeing it as killing a baby.</p> <p>Regret stronger if pressurised to have abortion.</p> <p>Ambivalence related to conflicting values</p> <p>Those who had experienced both:</p> <p>Shifting moral frame: from avoiding abortion as being responsible to having an abortion as being responsible in order to 'make something of oneself' for other child.</p> <p>Moralistic regret about prior abortion ('killing baby') and decision to become pregnant again.</p>

There are some themes resulting from the findings in Table 1.3 which are pertinent to the current argument. They are summarised here:

DISADVANTAGED INDIVIDUALS AND COMMUNITIES:

- More opposed to abortion
- Earlier ideal age at parenthood
- Limited education/employment prospects
- More likely to know teen mothers
- Motherhood as central life role

MORE ADVANTAGED INDIVIDUALS AND COMMUNITIES:

- More accepting of abortion
- Later ideal age at parenthood
- Deem ability to support a child as necessarily preceding maternity.
- Mention opportunity costs of pregnancy/maternity re: career, university, money and personal development

MORAL POSITIONS ON ABORTION:

- Unstable: after childbirth some became more pro-abortion
- Contingent on circumstances (e.g. employment; ability to cope; current child's welfare)
- Rarely developed in the abstract

INFLUENCES ON DECISION:

- Unconditional parental support often led to maternity
- Perception of own future life
- Derived from existing views, plus views and experiences of those nearby

Qualitative research never explicitly addresses health, but there are hints of fertility postponement via abortion for educational opportunities, and socioeconomic differentials in ideal age at maternity, consistent with an accelerated life course for the deprived (perhaps for health reasons) and concomitant exacerbation of trade-offs between education/career and reproduction.

1.6.7 Is the ‘morality’ of abortion really just reproductive interests talking?

Abortion is widely thought of chiefly as a moral issue, and there are socioeconomic differences regarding the perception of it as we can see from Table 1.3. As these differences are, however, contingent on personal circumstances and not well developed in the abstract (Hoggart, 2012; Lee et al., 2004). There do appear to be group subcultures regarding the acceptability of abortion (Burghes, 1999; Clements, Ingham, Lee, & Stone, 2004; Diamond et al., 1999). Religious and ethnic differences may explain some variation, although this can often be confounded with deprivation (D. M. Smith & Roberts, 2009). From a Human Behavioural Ecology viewpoint people’s own reproductive interests may be as salient as abstract moral beliefs, and indeed might even be what underpins them (Weeden, 2003). Environment and physiological condition (mortality and morbidity risk), age (point in reproductive lifespan), genetic interests, and likelihood of investing in embodied capital (education/employment) may determine one’s reproductive strategy regarding

abortion (Weeden, 2003), so those in similar circumstances would share similar views, and relatives may accordingly promote their own inclusive fitness by influencing young women's fertility timing (Hamilton, 1964). This could create local moral cultures regarding abortion. Explicit moral attitudes may indicate strategic post-hoc reasoning rationalising situationally derived actions, echoing much moral psychology research (Haidt, 2007; Hall, Johansson, & Strandberg, 2012; Mercier & Sperber, 2011; Pinker, 2008). Such local cultural contingency regarding abortion may be mediated by evolved psychological mechanisms producing varied behavioural outputs from varied environmental inputs, and many evolutionary behavioural scientists regard culture as situationally 'evoked' and thereafter socially transmitted, with no division between nature and culture (Gangestad, Hasleton, & Buss, 2006; Nettle, 2009, 2010b; Tooby & Cosmides, 1992). Therefore apparent 'cultural' differences regarding abortion might indicate varying ecologically and physiologically determined reproductive interests.

Although we can see in Table 1.3 some mechanisms of socioeconomic abortion disparities, there might be other influences which are not accessible to people's conscious minds and which are therefore less likely to be reported. Much psychological literature shows many determinants of behaviour are inaccessible to people's consciousness despite the ability to verbally offer justifications (Dell'Acqua & Grainger, 1999; Gazzaniga, 2005; Haidt & Bjorkland, 2006; Liljenquist, 2010; Turk, Heatherton, Macrae, Kelley, & Gazzaniga, 2003; Wegner, 2002; T. D. Wilson, 2002; Zeki, 2003), and research should examine influences beyond awareness. Any relationship between health and abortion's fertility scheduling function, whether conscious or unconscious, remains

unexamined in the literature, and hence presents a potential avenue for investigation. This is a reason for using psychological experiments to get at putative influences beyond awareness.

1.7 Previous experimental research

Therefore, what people say about their own motivation to reproduce might not capture unconscious influences. In terms of the bigger picture in Human Behavioural Ecology, if such cues do have an influence then this is an example of 'contextual evocation' (Nettle, 2011) whereby varying ecological inputs can result in adaptively pertinent behavioural outputs via evolved psychological mechanisms. Another name for contextual evocation is 'evoked culture' (Tooby & Cosmides, 1992), and where such mechanisms are chronically activated it is thought to be responsible for phenomena such as the links between ecology and reproductive timing in the Chicago neighbourhoods (M. Wilson & Daly, 1997) and between prematurely disabled female relatives and early fertility (Geronimus, 1996b), in the form of reproductive motivation. (It is not known, however, whether such psychological activation can occur chronically or whether it might be prey to habituation (R. F. Thompson, 2009) like other psychological effects.) Experimental psychology research, which manipulates cues and uses random allocation to experimental conditions, is potentially one way of getting at whether there is causality between any factors which show associations at population level. An overview of work investigating psychological mechanisms of fertility behaviour, including both observational and experimental research, is given in Appendix A, the NESCent Psychological Mechanisms of Fertility Behaviour Literature Review, a report co-written by the author of this thesis. In Appendix B is 'The Evolved Psychological

Mechanisms of Fertility

Motivation: Hunting for Causation in a Sea of Correlation', a journal article co-authored by Sandra Virgo and currently under review by Philosophical Transactions of the Royal Society B. (NB: Due to an error, Sandra Virgo's name does not appear on the copy here. This is to be rectified prior to publication.)

1.7.1 Mortality salience experiments

A number of researchers have investigated the effect of making people consider their own mortality. This research began within experimental social psychology, in a sub-field investigating Terror Management Theory, which says that as humans are simultaneously the only species with consciousness of their own mortality and meaning-making creatures, reminders of death mean that the ensuing emotional terror must be managed in some way and this often takes the form of increased adhesion to in-group cultural norms; symbolic immortality and other values which appear to give life meaning (Greenberg, Pyszczynski, & Solomon, 1986). A number of these experiments have found that when asked to consider their own death, participants show increased interest in offspring, measured both implicitly and explicitly with various dependent variables. Evolutionarily inspired authors (Griskevicius et al., 2011; Mathews & Sear, 2008) have then also taken up this mantle, interested in how the findings follow what might be predicted from life history theory. Table 1.4 summarises the key findings from these studies, including only those studies in cited papers which a) use experimental methods i.e. random assignment to conditions and b) use mortality salience priming to test its effect on variables somehow measuring reproductive motivation and/or pro-natalism. Overall the experiments show that mortality salience can make some individuals exhibit

greater reproductive motivation; parenthood-related feelings or fondness towards children than controls, but this may be attenuated in some cases for females (Mathews & Sear, 2008; Wisman & Goldenberg, 2005), especially those women with high 'career strivings' (Wisman & Goldenberg, 2005), and those individuals with high avoidant attachment (Yaakobi, Mikulincer, & Shaver, 2014). These individuals appear to be concerned about the cost of children, as when they are primed with information about compatibility of career/earning money and parenthood, they exhibit the same behaviours as other mortality-primed subjects (Wisman & Goldenberg, 2005; Yaakobi et al., 2014). It is also possible that the sex difference relates to the perceived cost for females of having a large number of children, as the sex difference is not seen where individuals are asked if they would like at least one child in their life (Fritsche et al., 2007), which perhaps increases the salience of potentially having no children at all. One of the studies influenced by life history theory (Griskevicius et al., 2011) found that mortality salience only significantly increased pro-natalism (measured by motivation to become a parent soon) for those who felt they had grown up in a relatively impoverished family. Zhou et al. (2008) used a more abstract dependent variable to measure pro-natalism: approval towards China's one-child policy, and achieved their predicted results.

1.7.2 Building on previous experimental research

The experiments described in Chapters Three and Four in the current thesis attempt to extend the existing mortality salience research where possible. Like Zhou et al. (2008), they use a novel dependent variable to assess reproductive motivation i.e. attitudes towards abortion. It is possible that measuring abortion attitudes taps into reproductive motivation in quite a different way to asking

people when they would like children or how many they would like to have, as in a hypothetical abortion dilemma the offspring's life has already minimally commenced, and a termination is an active choice away from the default situation, to take the pregnancy to completion.

Abortion attitudes are measured not only by asking people what they think of the acceptability of abortion in different hypothetical scenarios e.g. the woman has been raped; the woman simply does not want a child, but also by asking participants how far they think abortion would be a good choice if they or their female partner were to discover they were pregnant now. The reason for measuring abortion attitudes in these two different ways is that as we can see from the qualitative research reviewed in Section 1.5.6, despite abortion's position as a thorny moral issue in public life where people usually discuss the choices of third parties, in practice people's position on it appears to be contingent on personal circumstances and may be far more private.

The following experimental research is also undertaken online rather than in the laboratory for two reasons. Firstly, in order to get a more socioeconomically diverse group of participants than is usually seen in experimental psychology research which usually uses university undergraduates. As differences in exposure to morbidity and mortality form the crux of the theoretical assumptions of this research; and socioeconomic differences in levels of induced abortion and in abortion attitudes form the empirical background to this research, it would seem important to test whether any effects are moderated by socioeconomic status as Griskevicius et al. (2011) found. As Henrich, Heine, and Norenzayan (2010) contended, many psychological experiments are carried out in developed countries among highly

educated people and it is unlikely that this is representative of humanity. One aspect of their argument which is sometimes forgotten is that within societies there can be a great range of experiences just as there can be between societies. Indeed J Haidt, Koller, and Dias (1993) found greater differences in moral reasoning between uneducated and educated people within one country than they did between highly educated people from different countries. The other reason for using an online sample was that given the personally and/or morally sensitive topic area, filling in the questions anonymously might guard against social desirability bias.

The experiments detailed in Chapters Three and Four also go beyond investigating the effects of mortality salience and also investigate the psychological effects of a conceptual opposite, longevity salience (Chapter Three); and a stimulus which arguably might have more relevance than mortality salience in the UK, a developed nation with a welfare state, morbidity salience (Chapter Four). Longevity salience is included as one of the conditions in the first experiment in order to test the conceptual coherence of the assumptions of life history theory which underpins the mortality salience research so far undertaken in its name. If people, whether consciously or subconsciously report increased reproductive motivation when they are reminded of death, then logically they should report decreased reproductive motivation when they are asked to contemplate having a long, healthy life.

Morbidity salience is included in the next experiment as another treatment condition so that we can investigate whether thinking about chronic illness has any effect on reproductive motivation. Geronimus (1992) suggests that it is knowledge of imminent chronic illness which motivates the teenage mothers

she meets to have children relatively early. In modern developed nations people live longer than ever before, and the greater socioeconomic differentials appear to be in morbidity rather than mortality (Bajekal, 2005). Living a long time but in poor health is more a mark of societies and strata which have been through the epidemiological transition (Olshansky & Ault, 1986), a change from the shorter lifespans and communicable diseases which may have been more typical ancestrally. Therefore it is possible that reminders of the possibility of long-term illness would also have an effect on reproductive motivation in terms of making people want to have children earlier, although if this effect does exist it might not be as strong as any effect of mortality salience, whereby death is a greater threat to further reproduction than poor health.

Following the same logic, there are manipulation checks used in the experiments to see if the stimuli affect people's sense of how long they are going to live; and how long they think they will stay fit and healthy. In the mortality salience experiment in Chapter Three we also measure Subjective Life Expectancy; and in the morbidity salience experiment we also measure Subjective Disability-Free Life Expectancy. These also serve the purpose of elucidating whether any experimental effects that occur in abortion attitudes are somehow mediated by individuals believing that they will have a shorter (disability-free) lifespan. This is an attempt to look at whether the assumptions of our theoretical framework are true.

A bogus quiz is used as the format of the experiments which follow, echoing the methods of Mathews and Sear (2008). This should operate as a more unobtrusive stimulus than the common method used in the studies in Table Four which is to ask people to describe what will happen to them physically and

emotionally as they die, a method which is perhaps slightly more likely to arouse suspicion or hypothesis guessing.

Therefore the following experiments seek to advance the mortality salience research underpinned by life history theory, also attempting to replicate Griskevicius et al. (2011)'s finding that mortality salience stimulated a desire to have children earlier for those who said they had grown up relatively poor by using their measures of motivation for early parenthood. If their results substantively echo findings from Chapter Two's geographical analysis this will provide reasonable evidence of a link between perceptions of shortened (healthy) lifespan and reproductive motivation in the form of lowered inclination to terminate pregnancy.

Table 1.4: Summary of experimental research investigating the effects of mortality salience on reproductive motivation

AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
Wisman and Goldenberg (2005)	Dutch University students	<p>Study One: Mortality Salience (describe emotions while thinking of own death and describe what will happen to them physically when they die). Controls asked to describe emotions and physical experience of watching TV.</p> <p>Study Two: MS condition same as previous; control related to visiting the dentist i.e. an aversive stimulus.</p> <p>Study Three: MS stimulus same as before. Controls wrote about visiting dentist, same as S2. Participants' 'career strivings' measured with composite index.</p> <p>Study Four: Females only. Before main primes (MS and TV-related control), they read bogus articles: either a) children incompatible with career or b) children and career compatible. Measured on 'career strivings'.</p>	<p>Study One: Desire for offspring. "How many children would you like to have in your fantasy?" and "How many children would you like to have in reality?", each scored from 0 to 6 and averaged into composite index.</p> <p>Study Two: Desire for offspring as before.</p>	<p>Study One: Males in MS group desired more offspring compared to controls. Main effect of MS could not be attributed to mood. Both sexes had equal death-thought accessibility. No interaction with relationship status.</p> <p>Study Two: Males in experimental group desired more offspring. Females showed non-significant trend towards desiring fewer offspring in MS condition. MS group had stronger negative mood than controls, but this did not interact with condition and gender.</p> <p>Study Three: Males showed more desire for offspring in MS condition. Females desired fewer children in MS condition, a result driven by those with high 'career strivings'. No effects found for relationship status. Male results not mediated by desire for sex.</p> <p>Study Four: Women who read children-career compatibility article wanted more children in MS condition, similar to male results in previous studies. (Controls unexpectedly wanted fewer children if exposed to career-children compatibility essay.)</p> <p>Mortality salience elicits desire for more offspring in males. Sex difference appears to be result of perceived trade-offs between career and childbearing for females.</p>

AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
Fritsche et al. (2007)	German University students	<p>Study One: MS prime ("write down the first sentence that comes to mind when you think of your death"). Controls asked to think about dental pain.</p> <p>Study Two: MS prime was being asked to think about own death in terms of emotions and what will physically happen. Control group asked to write about having dental pain.</p>	<p>Study One: asked whether or not they had a general desire to have their own children one day. Composite scale of desire for offspring.</p> <p>Study Two: number of offspring-related words used in word-completion task to measure offspring-related accessibility</p>	<p>Study One: Both sexes more likely to say they would like at least one child compared to controls. Also more likely to indicate a stronger desire for children on a composite scale. No change when those with children excluded from analysis.</p> <p>Study Two: Both sexes more likely to use offspring-related and death-related words (the latter acting as manipulation check) in a word-completion task than controls.</p>
Zhou et al. (2008)	China University students	Study One: Both experimental and control group did 30 word-completion tasks. Control group filled in neutral words; mortality salience condition filled in 10 words out of 30 associated with death (e.g. funeral and coffin).	Study One: approval of China's one-child policy on 1-7 scale, having read a description of it.	Study One: Mortality salience decreased approval towards China's one-child policy. No sex difference.

AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
Zhou et al. (2009)	China University students	Study One: Participants in MS group asked to write about what will happen when they physically die. Controls asked to write about a trip to the dentist.	Study One: length of time viewing pictures of people under 5 years old. Number of pictures (up to 5) of under-5s selected as favourites among other pictures of objects and adults.	Study One: those in MS condition viewed pictures of young children for longer than controls; and were more likely to select the same pictures as their favourites. Women both viewed baby pictures for longer, and were more likely to select them as favourites than males, but this did not interact with condition.
Mathews and Sear (2008)	UK International university students Online experiment	Study One: Mortality priming was bogus mortality-related quiz containing factual and emotional questions related to death. Controls were asked the same questions as for the dependent variable, but did the bogus mortality quiz afterwards.	Study One: ideal number of children. Question on how likely it is that they will be able to have that number of children. Questions on perceived costs/benefits of children on time, financial, employment, social and emotional dimensions, measured on semantic differential scales.	Study One: Under MS, males had increased ideal number of children. When males who wanted no children were excluded from analysis, treatment effect increased. No significant effect for females. Males in MS condition showed non-significant trend of viewing children as less costly and more beneficial than control males. Excluding those who wanted no children gave similar results. Sex difference might be explained by differential costs for males and females in having additional children.

AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
Taubman-Ben-Ari and Katz-Ben-Ami (2008)	Israel First-time mothers of babies aged 3-12 months	Study Two: Mothers in MS condition told "Please describe briefly the emotions that the thought of your own death arouses in you," and "What do you think happens to you as you die and once you are dead?" Controls asked to think about a neutral theme (TV viewing habits).	Study Two: scores of anxiety, sadness and guilt on Maternal Separation Anxiety Scale, tapping into these emotions experienced when mother separated from baby. Measure of attachment anxiety and avoidance measured on a scale.	Study Two: Mortality salience induced higher maternal separation anxiety. The higher the level of attachment avoidance, the higher the mother's separation anxiety.

<p>Griskevicius et al. (2011)</p>	<p>US University students</p>	<p>(Study One not an experiment) Study Two: MS condition read bogus news article on increased deaths in US due to random violent crime. Controls read similarly formatted article on a man losing his keys and looking around the house for them. Pre-tests showed that both articles were similarly emotionally arousing; but only the MS article elicited uncertainty about the future and greater perceived danger in the future.</p> <p>Study Three: Same MS prime as Study Two; Controls read no article.</p> <p>Study Four: MS prime same as before. Control group read nothing.</p>	<p>Study Two: Questions on family planning decisions: (1) would you like to have a child in the next few years? (2) If you were to have a child in the next few years, how would you feel? (3) How disappointed would you feel if you did not have a child in the next few years? Combined into composite index.</p> <p>Study Three: Desired age at first reproduction: (1) how old do you think you'll be when you have your first child? (2) "If you were to have children, in how many years do you think you will have children?" Questions on when they wanted to get married and by what age do they think they will be married.</p> <p>Study Four: Starting a family vs. furthering education/career: (1) "If you needed to choose would you rather get married sooner or focus</p>	<p>Study Two: Females more interested in having children than males. The MS prime only significantly increased reproductive motivation for those with a subjective childhood SES one standard deviation or more below the mean. Those who had subjective childhood SES at least one SD higher than the mean had more negative attitudes to early reproduction when mortality primed.</p> <p>Study Three: The only effect of MS prime was that people at least one SD below the mean of subjective childhood SES wanted to marry sooner and have children sooner compared to controls. Under the MS prime, those at least one SD above the mean in subjective childhood SES wanted to delay marriage and reproduction.</p> <p>Study Four: MS prime meant that those with a high reported childhood household income were significantly more interested in investing in education/career at the cost of having children sooner compared to controls. No effect for those with low childhood SES.</p>
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AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
			<p>on your career?"; (2) "if you needed to choose would you rather start a family earlier or go to graduate school for many years to further your education?"; and (3) "if you needed to choose would you rather have children sooner OR further your career?". These items were combined to form a family versus career index.</p>	

AUTHORS AND YEAR OF PUBLICATION	SAMPLE/POPULATION	MAIN INDEPENDENT VARIABLES AND CONTROLS	DEPENDENT VARIABLES	KEY FINDINGS INCLUDING IMPORTANT INTERACTIONS
(Yaakobi et al. (2014))	Israel University students	<p>Study One: MS condition: "Please describe the emotions that the thought of your own death arouses in you" and "What do you think happens to you as you physically die and once you are physically dead?"; control condition one asked to think of physical pain; neutral controls asked to think about eating.</p> <p>Study Two: MS condition as before or physical pain control condition as before.</p> <p>Study Six: MS condition for two-thirds of participants; neutral eating food control condition for the rest. Half MS participants then told that people with children more satisfied with jobs and earn more. The other half of MS group told that big city residents earn more than small city residents. All those in eating food condition also told that big city residents earn more.</p>	<p>Study One: Measures on questionnaire of importance of parenthood-related cognitions and vividness of parenthood-related imagery.</p> <p>Study Two: Accessibility of parenthood-related thoughts measured by response times on lexical decision task re: whether letter strings are words in four categories: parenthood-related, positive words, neutral words, non-words.</p> <p>Study Six: Measures on questionnaire of importance of parenthood-related cognitions and vividness of parenthood-related imagery.</p>	<p>Study One: MS increased self-reported importance, vividness and implicit accessibility of parenthood-related cognitions, compared to the two control conditions. Under MS, parenthood-related imagery was only more vivid for people low in avoidant attachment. If those high in avoidant attachment are primed with the idea that parenthood is compatible with career success, they report important and vivid parenthood-related thoughts.</p> <p>Study Two: MS increased self-reported vividness and implicit accessibility of parenthood-related words compared to those which were positive, neutral or non-words. This occurred only for those low in avoidant attachment.</p> <p>Study Six: When parenthood was primed as being compatible with career success, even highly avoidant participants reacted to mortality salience with more positive and vivid parenthood-related cognitions.</p>

1.8 Summary of previous research

There are consequently theoretical and empirical reasons to suppose socioeconomic abortion differentials may relate to deprived people's heightened morbidity and mortality risk disinclining them to postpone reproduction, but existing population-level research has almost never examined health deprivation's contribution. It is also the case that although previous experimental psychology work has found that mortality salience appears to increase people's interest in having children, it has not yet been examined whether a) mortality salience might concomitantly make people more disapproving of abortion and whether b) people might also respond to morbidity salience in the same way, following the logic of life history theory and the 'weathering hypothesis'. Next I outline the research which follows in this thesis.

1.9 Aims of the current research

I have argued that mortality and morbidity have almost never been examined as a potential influence on socioeconomic disparities in abortion behaviours and attitudes. The central aims of this research are:

1. To determine whether there are population-level associations between mortality/morbidity and AP, having controlled for other socioeconomic factors; and to explore differences between different age bands. This study is described in Chapter Two, the next chapter.
2. To test whether mortality salience affects a) attitudes to abortion and b) interest in early parenthood via unconscious psychological mechanisms in a sample of young adults. This experiment is described in Chapter Three.
3. To test whether morbidity salience affects a) attitudes to abortion and b) interest in early parenthood via unconscious psychological mechanisms in a sample of young adults. This experiment is described in Chapter Four.

If it can be shown that there are both population-level associations between higher mortality/morbidity and lower AP; and that mortality/morbidity salience

results in decreased abortion approval, then it is possible that mortality/morbidity work to increase pro-natalism and lower abortion approval in the real world via the mechanisms assumed by life history theory and the weathering hypothesis i.e. shortened perceived life expectancy. The research in the following chapters seeks to investigate this.

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Student	SANDRA VIRGO
Principal Supervisor	DR. REBECCA SEAR
Thesis Title	Are risk of mortality and morbidity determinants of abortion behaviour and attitudes in England & Wales?

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?	
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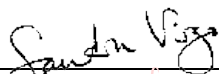
SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	EVOLUTION AND HUMAN BEHAVIOR
Please list the paper's authors in the intended authorship order:	SANDRA VIRGO, REBECCA SEAR
Stage of publication	UNDER REVIEW

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Sandra Virgo was responsible for designing this study, conducting it, analysing the data and writing up results. Rebecca Sear supervised the study and contributed to writing up the paper.
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Student Signature: _____



Date: 28/09/2015

Supervisor Signature: _____

Rebecca Sear

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Chapter 2 Area-level mortality and morbidity predict abortion proportion in England and Wales

Life history theory predicts that where mortality/morbidity is high, earlier reproduction will be favoured. A key component of reproductive decision-making in high income contexts is induced abortion. Accordingly, relationships between mortality/morbidity and 'abortion proportion' (proportion of conceptions ending in abortion) are explored at small-area ('ward') level in England and Wales. It is predicted that where mortality/morbidity is high, there will be a lower 'abortion proportion' in younger women (<25 years), adjusting for education, unemployment, income, housing tenure and population density. Results show that this prediction is supported: wards with both shorter life expectancy and a higher proportion of people with a limiting long-standing illness have lower abortion proportions in under 25s. In older age bands, in contrast, elevated mortality and morbidity are mostly associated with a higher 'abortion proportion'. Further, morbidity appears to have a larger effect than mortality on 'abortion proportion' in the under-25 age band, perhaps because a) morbidity is more salient than mortality in high-income contexts, and/or b) young women are influenced by health of potential female alloparents when scheduling fertility.

2.1 Life history theory and mortality

Life history theory posits that over the life course organisms face tradeoffs in allocating energy between competing functions such as growing, learning, mating, reproducing and self-care (Roff, 1992; Stephen C Stearns, 1992). The optimal balance of these trade-offs to maximise reproductive fitness will depend on the local ecology (Schaffer, 1983). One characteristic which varies between ecologies is extrinsic mortality (and morbidity) risk, defined as "the risk of death that is not conditional on an organism's reproductive behaviour" (Stephen C Stearns, 1992). An organism cannot escape extrinsic mortality by behaving differently, as it is the "age-specific risk of death that is equally shared by all members of a population" (Quinlan, 2010). Such risks are therefore important in setting the time horizon of energetic allocation, which will change the costs and benefits of energetic allocation to each respective function and the prioritisation of each. Mortality and morbidity curtail ability to conceive, bear and care for offspring (Geronimus et al., 1999).

Indicators of a high mortality environment may mean 'faster' life histories, typified by accelerated reproductive development and earlier age at first reproduction, so that reproduction is temporally prioritised over growth and learning, in order to ensure it takes place while still relatively young and healthy.

'Slower' life histories occur in low mortality/less risky environments (Charnov, 1991), where individuals can afford to substantially invest in their embodied capital before reproducing.

Life histories can diverge between species (Promislow & Harvey, 1990) and within species (Reznick et al., 1990); and are not necessarily governed by conscious decision-making (Engqvist & Sauer, 2002; Javois & Tammaru, 2004). Across 22 small-scale human societies, high mortality rates were associated with earlier age at menarche and earlier reproduction (Walker et al., 2006). Such adaptations can happen over evolutionary time (Migliano et al., 2007); or within a lifespan, environmental cues can influence an organism's phenotype via evolved adaptive mechanisms. Within human lifespans, such effects may occur via physiological and psychological mechanisms (Del Giudice & Belsky, 2011; Nettle, 2010b). As long as individuals are receiving enough calories to be fertile, mortality is therefore expected to influence reproductive scheduling (Belsky, Schlomer, & Ellis, 2012).

2.2 Socioeconomic Status, mortality and morbidity

This theoretical framework has been used to help explain socioeconomic differences in reproductive behaviour in high income contexts in our own species (Nettle, 2010a). Poorer people when compared to richer people are more exposed to extrinsic morbidity and mortality hazards such as accidental death, homicide, air pollution and heart disease in their localities, adjusting for individual-level factors (Bolte et al., 2010; Cubbin et al., 2000; G. D. Smith et al., 1998). Morbidity can have even sharper socioeconomic differentials (Bajekal, 2005). It has now been consistently shown that within developed societies poorer people have children earlier (Geronimus et al., 1999; Imamura et al., 2007; Joshi et al., 2004; Nettle & Cockerill, 2010). This empirical finding stimulated the 'the weathering hypothesis' (Burton, 1990; Geronimus, 1992, 1996a, 1996b), which suggests that those with higher mortality and morbidity risk may schedule fertility earlier to mitigate reproductive costs, which increase more rapidly with age in those who experience relatively high burdens of

morbidity. Nettle and colleagues have developed an explicitly evolutionary version of this hypothesis, whereby such behaviour makes sense in terms of maximising fitness (Nettle, 2010a; Nettle, 2011; Nettle & Cockerill, 2010). Further increasing the incentives to earlier reproduction is the suggestion that there can be educational and career benefits to delaying childbearing, but those at greater risk of mortality/morbidity may be less able to make these investments, despite potential long-term benefits to children (Bulled & Sosis, 2010; Geronimus, 1996b; H Kaplan et al., 2000; Krupp, 2012; B S Low et al., 2008; Nettle, 2010b; Nguyen et al., 2012). Poorer families appear to disperse less for economic opportunities (Murphy, 2008; Sear & Dickins, 2010), which means that childcare is more likely to be undertaken by family (Kramer & Lancaster, 2010), so that early reproduction is optimal before one's relatives (mother, for example) see early functional limitation and mortality (Bajekal, 2005; Geronimus et al., 1999).

2.3 Abortion and termination of investment in offspring

Research so far on links between mortality risk or socioeconomic status and the timing of childbearing have focused largely on births or conceptions. Conceptions do not always lead to births, however. A key component of reproductive decision-making in high income contexts is induced abortion. In most such contexts, safe medical abortion is relatively easily accessible and widely used by women as a means of managing their reproductive lives. Its incidence in developed countries where it is legal ranged in 2008 from 30 per 1000 women aged 15-44 in Estonia to Switzerland (seven per 1000). In terms of the proportion of pregnancies that end in induced abortion, the lowest in 2008 was in Israel (10%) and the highest was again in Estonia (30%) (Sedgh, Singh, Henshaw, & Bankole, 2011). Indeed, in some countries there has long been a tendency to use abortion as a contraceptive (e.g. in the former Soviet states)(Agadjanian, 2002); while in others, even where abortion is illegal, unsafe informal procedures or alternatives like menstrual regulation or abortifacients are used (Sedgh et al., 2011; Vlassoff, Hossain, Maddow-Zimet, Singh, & Bhuiyan, 2012). Therefore it can be seen as an important means of managing reproduction.

Hrды (1979) argues that termination of investment in an offspring (e.g. infanticide) is an adaptive reproductive strategy in animals including primates in circumstances where there can be increased maternal survival or reproductive success of either parent “by elimination of an ill-timed, handicapped or supernumerary infant”. She also points out that in comparison to other primates humans are unusual in that they quite frequently terminate investment in infants, something which she attributes to the high costs of raising human children (Hrды, 2009). This means there may well be an associated evolved psychology which enables facultative variation in the decision as to whether to continue investment in an offspring. Ancestrally, induced abortion was riskier for the mother than now, and infanticide was safer. In developed societies the situation is reversed, especially if abortion takes place in the early stages of pregnancy. Modern contraception means fewer conceptions, but where these do occur, the decision whether to continue or terminate the pregnancy is likely to be the outcome of conscious deliberation. The gain for the parent can depend on their personal attributes e.g. age and likely opportunity cost of bearing and rearing offspring currently, which may in itself vary depending on local resources and risks.

Theoretically speaking, we would expect abortion rates to vary with age. Abortion rates show a J-shaped curve with age, at least in high income contexts – younger women tend to be the most likely to abort, abortion rates are lowest among women in their thirties then start to increase towards the end of the reproductive period (Lycett & Dunbar, 1999). This likely reflects both the changing costs and benefits of abortion with age – younger women have more opportunity to conceive again – and also the different reasons for abortion – younger women may be using it to manage the timing of their reproduction (e.g. to allow time for education or career-building; finding a secure partnership) (Lee et al., 2004; Lycett & Dunbar, 1999) while older women may be using it to manage family size or to abort less viable foetuses (as the risks of chromosomal abnormalities increase with maternal age). Environments with high mortality/morbidity may be ones where norms encouraging investment in higher education do not develop because the long-term benefits of education are less clear, as waiting to reproduce may be a risky strategy. If this is the case then there is less need for fertility postponement and therefore we would

expect to see lower abortion levels in younger age groups here, and indeed there is an inverse relationship between education and abortion among young women (Diamond et al., 1999; Lee et al., 2004; Lo, Kaul, Kaul, Cooling, & Calvert, 1994; Wood, 1996).

2.4 Deprivation and abortion in the UK

There has been some previous research on how deprivation influences abortion. In the UK, more deprived individuals and communities have both lower levels of abortion (controlling for conceptions), and show less acceptance of it (Lee et al., 2004). Research on links between abortion and deprivation mostly comes from policymakers' interest in teenage pregnancy. These studies tend to measure deprivation in different ways, owing to its multidimensional nature. Much of the research also uses area-level data, given the sensitive nature of abortion and concerns about the risk of revealing individual identities. Quantitative area-level research often uses 'abortion proportion' as its outcome variable, i.e. the proportion of conceptions ending in abortion, hereafter AP. At area level it is often the case that deprived areas with a high teenage conception rate also have a low AP (Bradshaw et al., 2005; Garlick et al., 1993). There are descriptive and correlational studies (Garlick et al., 1993; Griffiths & Kirby, 2000; T. Smith, 1993; Uren et al., 2007; Wilkinson et al., 2006; S. H. Wilson et al., 1992; Wood, 1996) and multivariate research (Bradshaw et al., 2005; Conrad, 2012; Diamond et al., 1999; Lee et al., 2004; McLeod, 2001) showing the inverse relationship between deprivation and abortion. There is also some questionnaire and survey research confirming the same pattern at individual level (Lo et al., 1994; D. M. Smith & Roberts, 2009; Wellings, Wadsworth, Johnson, Field, & Macdowell, 1999). The studies just cited also show that repeatedly, deprivation is a far stronger factor in AP than the proximity and availability of contraception and abortion services, or the balance of state versus private provision; although in Phase Two of one study both the percentage of female GPs in local authorities and an index of opening hours of family planning clinics were also significant in final models (Lee et al., 2004). Similar patterns may hold elsewhere: one study in Barcelona shows that although with unintended pregnancy, women of lower socioeconomic position are more likely to choose abortion, this is not the case when they are young

(Font-Ribera, Perez, & Borrell, 2008). And in the US and Sweden, deprived teens are less likely to have abortions than richer ones (Harding, 2003; Olausson, Haglund, Weitoft, & Cnattingius, 2001). However, it remains to be seen whether morbidity and morbidity are contributors.

2.5 Limitations to previous research

If deprivation is associated with higher mortality and morbidity risk then the research described above suggests that mortality and morbidity will be linked to abortion proportion, but little research has directly tested this hypothesis. Even the most sophisticated studies (Diamond et al., 1999; Lee et al., 2004) have not used health measures among their deprivation indices. Although Wilson et al. (1992) find area-level associations between AP and Standardised Mortality Ratio, SMR was their only deprivation measure with no controls used. The only multivariate research measuring health (Bradshaw et al., 2005) finds 'health deprivation and disability' retaining significance where other deprivation measures like income, housing, child poverty and education, skills and training do not, but the study measures health at local-authority area level, an area too large and heterogeneous to really tell us much. Although Krupp (2012) found in Canada that life expectancy positively predicted abortion rate for the under-15s and over-40s, controlling at provincial level for median household income and at health region level for annual personal income, the geographical areas used are large and heterogeneous; and more varied socioeconomic controls would be ideal, as well as examining patterns in different age bands. If, as the evolutionary literature assumes, local cues to mortality are acting as inputs to evolved psychological mechanisms for reproductive motivation (Nettle, 2010b; M. Wilson & Daly, 1997), then it is important to use small geographical areas to assess local correlations. The current study is able to do this, explained more in the Method section.

2.6 Aims of the current research

The main research herein makes predictions regarding relationships between abortion and health in the under-25 age band only, as it is here where abortion is most likely used as a means of fertility postponement due to educational/career opportunities. For older age groups abortion relates less to

fertility timing (Bankole, Singh, & Haas, 1998; Finer, Frohworth, Dauphinee, Singh, & Moore, 2005; Lycett & Dunbar, 1999; Sihvo, Bajos, & Ducot, 2003; Tullberg & Lummaa, 2001). Due to the lack of parity information in the AP measure, we cannot tell whether abortion in the older age bands is being used for fertility postponement or family size limitation, and this is likely to vary between socioeconomic groups within a given age band due to differential fertility commencement ages. Adjusted relationships between abortion and health are explored in three older age bands (25-29, 30-34 and 35 and over). We test the following hypotheses:

Hypothesis One:

Area-level mortality will be negatively related to area AP in the under-25 age band, all else equal. This means that life expectancy measures will see a positive relationship with AP, adjusting for education, income, unemployment, population density and housing tenure.

Hypothesis Two:

Area-level morbidity will be negatively related to area AP in the under-25 age band, all else equal. This means that the measure of morbidity prevalence (i.e. age-standardised long-term limiting illness) is predicted to have a negative relationship with AP, adjusting for education, income, unemployment, population density and housing tenure.

2.7 Method

2.7.1 Geographical units: the ward

The geographical level used for our data is the ward. These originated as the spatial units used to elect local government councillors within the UK. Since the original electoral wards tended to undergo frequent boundary changes, different types of ward have been created for statistical use. More detail about the merging of data from different ward types necessary for this study is

available in the Appendix. In summary, most of the data used here are from the 2001 national Census, with other data centred approximately around this time period. All the data are from England and Wales, since data are collated and summarised differently in other parts of the UK. The final sample size was 8752 wards, reduced from an initial 8,850 due to boundary merging issues mentioned in the Appendix. For full details of the construction of variables, ward types, and sources of data, see Appendix B. Census Area Statistics (CAS) wards for 2001 had a mean population of 5,968 (Min. = 66; Max. = 35,748). This means that they have a far smaller population size than the kinds of geographical entities largely used in previous abortion research. This should reduce any problems involved in making area-level assumptions about 'local cues' and somewhat mitigate the ecological fallacy, the false assumption that the same relationships seen at aggregate level necessarily hold at individual level (Piantadosi et al., 1988). As Lancaster, Green and Lane (2006) note, in the absence of individual-level information, ward-level data are more useful than those covering larger areas as between-area variability is preserved.

2.7.2 Abortion data

Individual-level abortion data were unavailable from the Office for National Statistics (ONS) due to their sensitive and confidential nature, but the acquired ward-level data are at a greater level of resolution than the routinely available local authority-level figures. Additionally, because conception and abortion are both relatively rare events, for reasons of statistical reliability data were aggregated from 1999 to 2003. Although the resulting measure, 'abortion proportion' (AP) cannot show base conception rates, it may be seen as an aggregation of individual-level effects and/or ecological norms which can then be assessed for their association with area-level mortality, while adjusting for multiple socioeconomic factors. In using morbidity as an independent variable we can also examine whether any putative evolved psychological mechanisms might also be sensitive to cues to chronic ill-health. Abortion proportion is calculated jointly by the Department of Health (DoH) and the ONS. The DoH receive notifications of abortion from both private and National Health Service facilities (i.e. those defined as legal under the Abortion Act 1967); while maternity data (number of pregnant women who give birth, including one or

more live or still births) comes from the ONS, who process birth registrations. The number of conceptions is thus inferred, and does not include miscarriages or illegal abortions.

2.7.3 Mortality and morbidity measures

Mortality was measured as life expectancy (LE: defined as the average number of years a newborn baby would survive if he or she experienced the ward's age-specific mortality rates for that time period throughout his or her life); and for morbidity it was the age-standardised prevalence of limiting long-term illness (LTLI) (where 'limiting' is defined as 'limiting daily activities'). The LE measure was chosen as a general assay of mortality, and is used for comparing wards as it is an age-standardised measure (i.e. not confounded by potential differences in age structure between wards); the available LTLI prevalence measure was then also age-standardised by the first author in order to avoid the same problem of confounding. LTLI is also a pertinent measure for operationalising the kind of morbidity thought by Geronimus (1999; 1992, 1996b) to interfere with reproduction and childrearing.

The morbidity measure was constructed only for individuals living in households, and excluding those living in 'communal establishments' e.g. old-age care homes, etc. These populations are not seen out and about in the local area, so they are unlikely to contribute to 'cues' of morbidity, an assumption which underpins the theoretical background of this work. Ward-level LE estimates were calculated including these individuals, so our analyses control for a ward-level indicator of the proportion of the ward population aged 65 and over resident in Medical & Care establishments in 2001 (i.e. nursing homes, residential care homes, hospices and hospitals).

2.7.4 Analytic strategy and choice of controls

Initial relationships between mortality (LE) or morbidity (LTLI) were tested using regression analysis. As the dependent variable (AP) took the form of a proportion, linear regression was inappropriate as predicted values would potentially have lain beyond 0 and 1. Instead, a generalised linear model was used with a logit link function to model the data with fractional logistic

regression (Papke & Wooldridge, 1996). All models were run separately for the following age bands: <25 years, 25-29, 30-34 and 35 and over.

Controls were then added to adjust for separate aspects of 'deprivation', which in aggregate predicts abortion proportion in young women, as seen in previous research. From previous multivariate work some disaggregated aspects of deprivation which have seen significant relationships with AP include general area prosperity (positive) (Griffiths & Kirby, 2000; Wood, 1996); proportion of students (positive) (Diamond et al., 1999); unemployment (both positive and negative)(Lee et al., 2004; Wilkinson et al., 2006); percentage of 11-15-year-olds dependent on parents claiming Family Credit, a historic UK state benefit for those on low pay (negative) (Lee et al., 2004); and access to services (negative) (Bradshaw et al., 2005), although these relationships are not consistent across studies nor always available at ward level. Therefore for the current study, controls were picked from available ward-level data from around the 2001 time period which were both standard indicators of deprivation/prosperity and which had some relationship with both mortality/morbidity and AP, not difficult due to the multidimensional nature of deprivation where different aspects are inter-related. Although initially it was intended to include covariates measuring the proportion of the population of different ethnicities and religions/no religion, there was very small variance in most of these variables as most wards had overwhelmingly white British populations identifying as Christian. Accordingly these variables were excluded from the analysis. The final controls used were the following, with more detail under 'Covariates' in the Appendix.

- Education: proportion of people aged 16 to 74 with level 4 and 5 qualifications
- Unemployment: proportion of people aged 18 to 64 claiming Jobseekers' Allowance
- Income: average weekly household net income equivalised after housing costs (pounds sterling)
- Housing tenure: proportion of people in each type of housing tenure: owner-occupied; social rented housing; privately rented housing; rent-free

- Population density (dummy variable): urban (>10K population); Town and Fringe; Villages, Hamlets and Isolated Dwellings

A correlation matrix showing relationships between independent variables co-occurring in the same model unsurprisingly indicated high collinearity (exceeding .8) between proportion of population in owned housing and the proportion of people in social rented housing (-.87). Therefore the latter variable was omitted from analyses. As the goal of the analysis was not to produce a predictive model with the fewest number of variables, but to adjust for baseline differences between wards to avoid confounding, controls were entered in the model simultaneously (Katz, 2011) in order to test whether associations between mortality/morbidity and AP remained after these adjustments.

2.8 Results

Summary statistics for variables are seen in Table 2.1.

Table 2.1: summary statistics and frequencies for variables used in analysis

VARIABLE	AVAILABLE N; MEAN; STANDARD DEVIATION; RANGE; PERCENTAGE FREQUENCIES				
INDEPENDENT VARIABLES					
	N	Mean	SD	Min.	Max.
Mortality – Life Expectancy (LE) in years	8752	78.9	2.6	65.4	93.4
Morbidity – Age-standardised long-term limiting illness prevalence (LTLI)	8752	.17	.04	.08	.37
DEPENDENT VARIABLES					
Abortion proportion age bands:	N	Mean	SD	Min.	Max.
Under-25	8747	.36	.14	0	1
25-29	8750	.15	.08	0	.6
30-34	8752	.12	.06	0	.44
35 and over	8736	.21	.08	0	.71
NB: A handful of wards have missing 'abortion proportion' data as where there are very small raw numbers they are suppressed by the Office for National Statistics for confidentiality reasons.					
COVARIATES – CONTINUOUS VARIABLES					
	N	Mean	SD	Min.	Max.
Education - proportion of people aged 16 to 74 with level 4 and 5 qualifications	8752	.20	.09	.03	.66
Unemployment - Proportion of people aged 18 to 64 claiming Jobseekers' Allowance	8752	.21	.02	0	.14
Income - Average weekly household net income estimate equivalised after housing costs (pounds)	8752	£350.17	£83.52	£170	£1000
Housing tenure - Proportion owner-occupied:	8752	.74	.14	.12	.99
Housing tenure - Proportion social rented housing:	8752	.15	.12	0	.83
	N	Mean	SD	Min.	Max.
Housing tenure - Proportion privately rented housing:	8752	.09	.07	0	.69
Housing tenure - Proportion rent-free:	8752	.02	.01	0	.33
COVARIATES – CATEGORICAL VARIABLES					
Population density - Urban/rural	Total N				8752
	Urban > 10k population				N = 5636 (64.40%)
	Town and Fringe				N=1327 (15.16%)

	Villages Hamlets & Isolated Dwellings	N=1789 (20.44%)
Proportion of persons living in Medical and Care establishments (quintiles) From 0 (none of population in these establishments) to 5 (many of population in these establishments) NB: used only in models featuring Life Expectancy as independent variable	Total N	8752
	0 - none	N=2893 (33.06%)
	1	N=1006 (11.49%)
	2	N=1889 (21.58%)
	3	N=1183 (13.52%)
	4	N=855 (9.77%)
	5 - many	N=926 (10.58%)

Results for the unadjusted models indicating relationships between mortality/morbidity and AP in all age bands are shown in Tables 2.2 and 2.4. The adjusted models for AP in all age bands are shown in Tables 2.3 and 2.5. As indicated earlier, we used fractional logit models due to the dependent variable being a proportion; and models are separate for age bands <25 years, 25-29, 30-34 and 35 and over.

Supporting our hypotheses, elevated mortality and morbidity were both associated with lower under-25 AP, when adjusting for education, income, population density, unemployment, and housing tenure. Elevated mortality and morbidity were however associated with higher AP for age bands 25-29 and 30-34, all else equal. Therefore we find that in disaggregating mortality and morbidity from other socioeconomic measures, there remains an association with AP, supporting the predictions from life history theory and the 'weathering hypothesis'. Nonetheless, while 35 and over AP is also positively predicted by elevated mortality, there exists no such relationship with elevated morbidity once controls are added.

Tables 2.3 and 2.5 show that once different components of deprivation are measured separately, they each have a different relationship to AP. Education shows a similar 'age flip' to mortality and morbidity, in that the relationship between it and AP is positive in age bands <25 and 25-29; and then becomes negative for age bands 30-34 and 35 and over. This switch therefore happens at an older age than for the relationship between mortality/morbidity and AP,

where the change in direction of effect is between the <25 and 25-29 age bands. Unemployment is consistently positively related to AP across age bands (notwithstanding the non-significant relationship for under-25s in Table 2.3), while income is the same but with a tiny effect size. Population density results show that, all else equal, both 'Town and Fringe' and 'Villages, Hamlets and Isolated Dwellings' wards have lower AP across all age bands than wards where the population is greater than 10,000 (although for both tables the result is non-significant for under-25s), and this effect seems to be stronger in the most rural wards. Across age bands the AP is positively associated with the proportion of private rented housing, all else equal, while a higher proportion of owned housing is associated with a higher under-25 AP, but thereafter a lower one. Thus the relationship between deprivation and AP is complex due to deprivation's multidimensionality, and differing opportunities and constraints relating to fertility across the lifespan.

Table 2.2: Results from unadjusted regression models show that life expectancy positively predicts abortion proportion in under-25s; and negatively predicts abortion proportion in older age bands

	Under-25 abortion proportion			25-29 abortion proportion			30-34 abortion proportion			35 and over abortion proportion		
	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z
Life Expectancy	0.088	0.003	<0.001	-0.048	0.003	<0.001	-0.094	0.002	<0.001	-0.053	0.002	<0.001
Proportion of population in Medical & Care establishments	0.049	0.004	<0.001	-0.018	0.004	<0.001	-0.052	0.004	<0.001	-0.033	0.003	<0.001
constant	-7.626	0.218	<0.001	2.076	0.227	<0.001	5.538	0.191	<0.001	2.897	0.177	<0.001

NB: proportion of population in Medical & Care establishments is included in unadjusted models as a high score can shorten ward life expectancy; and it is not a covariate associated with ward deprivation, unlike control variables used in adjusted models.

Table 2.3: results from adjusted regression models show that life expectancy positively predicts abortion proportion in under-25s; and negatively predicts abortion proportion in older age bands

	Under-25 abortion proportion			25-29 abortion proportion			30-34 abortion proportion			35 & over abortion proportion		
	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z
Life Expectancy	0.008	0.003	0.013	-0.014	0.003	<0.001	-0.016	0.003	<0.001	-0.009	0.003	0.006
Proportion of population in Medical & Care establishments	-0.004	0.004	0.223	-0.008	0.004	0.043	-0.016	0.004	<0.001	-0.012	0.004	0.001
DEPRIVATION-RELATED CONTROL VARIABLES												
Proportion of pop 16-74 with Level 4/5 qualifications	3.318	0.099	<0.001	1.596	0.095	<0.001	-0.462	0.091	<0.001	-1.027	0.087	<0.001
Household weekly income	0.001	0.000	<0.001	0.001	0.000	<0.001	0.000	0.000	<0.001	0.000	0.000	<0.001
Urban/rural (ref: population>10K)												
'Town and Fringe' wards	-0.113	0.014	<0.001	-0.172	0.017	<0.001	-0.156	0.017	<0.001	-0.094	0.016	<0.001
'Villages Hamlets and Isolated Dwellings' wards	-0.014	0.018	0.432	-0.250	0.020	<0.001	-0.290	0.019	<0.001	-0.206	0.018	<0.001
Proportion of pop 18-64 claiming Jobseekers' Allowance	0.069	0.527	0.896	4.308	0.505	<0.001	3.731	0.495	<0.001	1.675	0.526	0.001
Housing tenure:												
Proportion of population renting private housing	0.255	0.124	0.041	0.594	0.100	<0.001	0.626	0.094	<0.001	0.235	0.098	0.016
Proportion of population living rent-free	0.172	0.562	0.760	-1.728	0.505	0.001	-1.867	0.489	<0.001	-1.790	0.507	<0.001
Proportion of population living in owned housing	0.536	0.059	<0.001	-1.401	0.055	<0.001	-1.323	0.056	<0.001	-0.550	0.057	<0.001
constant	-2.577	0.258	<0.001	-0.392	0.259	0.130	0.183	0.249	0.463	-0.087	0.259	0.736

Table 2.4: Results from unadjusted regression models show that age-standardised long-term limiting illness negatively predicts abortion proportion in under-25s; and positively predicts abortion proportion in older age bands

	Under-25 abortion proportion			25-29 abortion proportion			30-34 abortion proportion			35 and over abortion proportion		
	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z
Age-standardised long-term limiting illness prevalence	-6.949	0.131	<0.001	1.901	0.135	<0.001	5.205	0.122	<0.001	3.088	0.117	<0.001
constant	0.620	0.024	<0.001	-2.080	0.025	<0.001	-2.894	0.022	<0.001	-1.859	0.021	<0.001

Table 2.5: adjusted regression models show that long-term limiting illness negatively predicts abortion proportion in under-25s; positively predicts abortion proportion in intermediate age bands; but does NOT predict 35 and over AP

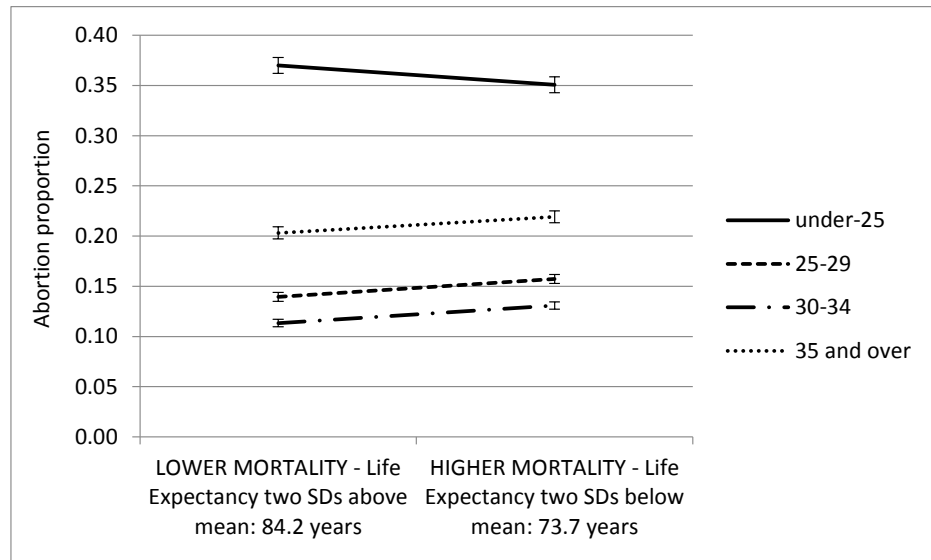
	Under-25 abortion proportion			25-29 abortion proportion			30-34 abortion proportion			35 and over abortion proportion		
	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z	Coef.	Robust Std. Error	P>z
Age-standardised long-term limiting illness prevalence	-2.456	0.212	<0.001	0.780	0.221	<0.001	1.175	0.230	<0.001	0.297	0.257	0.247
DEPRIVATION-RELATED CONTROL VARIABLES												
Proportion of pop 16-74 with Level 4/5 qualifications	3.170	0.097	<0.001	1.582	0.096	<0.001	-0.462	0.091	<0.001	-1.064	0.087	<0.001
Household weekly income	0.000	0.000	<0.001	0.001	0.000	<0.001	0.001	0.000	<0.001	0.000	0.000	<0.001
Urban/rural (ref: population>10K)												
'Town and Fringe' wards	-0.121	0.014	<0.001	-0.173	0.016	<0.001	-0.156	0.017	<0.001	-0.096	0.016	<0.001
'Villages Hamlets and Isolated Dwellings' wards	-0.028	0.018	0.113	-0.245	0.020	<0.001	-0.278	0.019	<0.001	-0.201	0.018	<0.001
Proportion of pop 18-64 claiming Jobseekers' Allowance	2.211	0.537	<0.001	4.241	0.527	<0.001	3.344	0.521	<0.001	1.794	0.569	0.002
Housing tenure:												
Proportion of population renting private housing	0.130	0.124	0.292	0.609	0.099	<0.001	0.634	0.094	<0.001	0.211	0.097	0.029
Proportion of population living rent-free	-0.133	0.555	0.811	-1.755	0.506	0.001	-1.849	0.491	<0.001	-1.818	0.507	<0.001
Proportion of population living in owned housing	0.398	0.056	<0.001	-1.416	0.053	<0.001	-1.337	0.056	<0.001	-0.591	0.057	<0.001

constant	-1.281	0.087	<0.001	-1.635	0.084	<0.001	-1.342	0.086	<0.001	-0.864	0.091	<0.001
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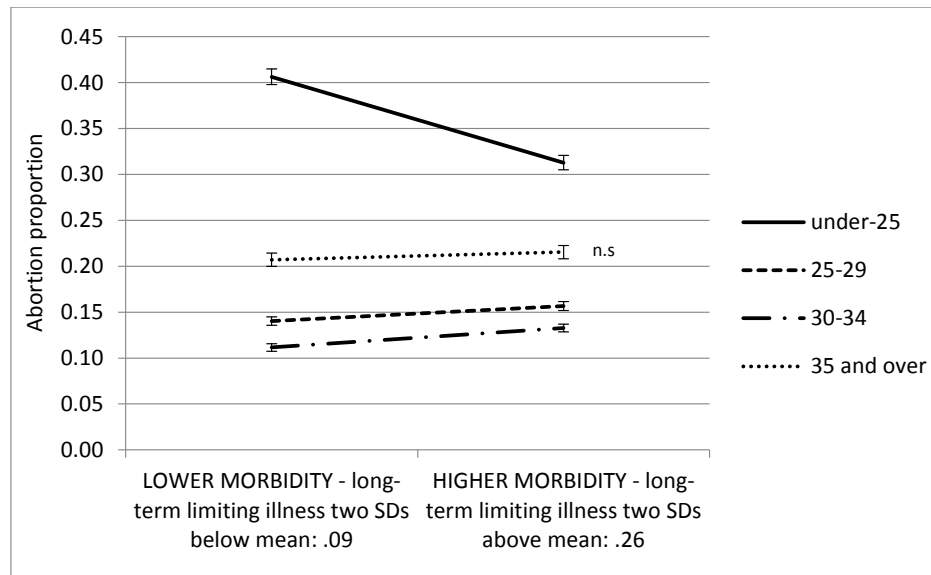
To illustrate effect sizes, we used Stata's *margins* command to compute predicted AP associated with the mortality/morbidity variables being held at two standard deviations above and below their means. Covariates are held at their existing values in the dataset and a simulation is run for each observation, with the effect then averaged. Results are shown in Figure 2.1 (a and b). Most apparent are the large effect of morbidity on the under-25 AP and the small effect sizes elsewhere.

Figure 2.1: Adjusted 'abortion proportion' predictions for all age bands in wards with a) Life Expectancy two standard deviations above and below the mean and b) age-standardised long-term limiting illness two standard deviations above and below the mean. Covariates held at values observed in dataset.

a)



b)



2.9 Discussion

2.9.1 Summary of results and support for hypotheses

Our analyses support our hypotheses: both mortality and mortality are significantly negatively correlated with AP in younger women (under age 25). This is in line with our prediction that, in an environment where (healthy) lifespan looks to be truncated, earlier reproduction is optimal: younger women are more inclined to take pregnancies to term in high risk environments. Further, we find these relationships are reversed in women 25 and over: both mortality and morbidity (except the latter in the 35+ age group) are positively associated with AP. The general reversal of the direction of this effect for older age bands may indicate that despite earlier reproductive onset, such ecological conditions may prevent prolonged reproductive careers. One may speculate that individuals do not wish to bring multiple offspring into either a) a dangerous environment or b) into a family where poor health or early mortality is the norm. This may echo Geronimus' (1992, 1996b) contention that it is not just a potential mother's health which must be assessed before childbearing; but also that of the wider family, especially in situations where relatives live nearby and assist with caretaking.

The adjusted predictions make clear that for under-25 AP morbidity has a large effect, all else equal; the effect size for mortality is somewhat smaller. This might be simply because we live in a very low-mortality society. When mortality and morbidity within the UK are assessed using comparable measures like Life Expectancy and Disability-free Life Expectancy, it is known that there are greater socioeconomic differentials in morbidity (Bajekal, 2005). Alternatively, local morbidity might emerge as the stronger predictor because it is more likely to affect females than males (who tend to die younger but suffer fewer unhealthy life years) (Bajekal, 2005). As it is usually females who are more involved with alloparenting, cues to local morbidity (rather than mortality) might be more pertinent to whether a child can be successfully raised. Commencing fertility is a more key life event than continuing fertility since in the latter case some reproductive success is already achieved. There could be a larger effect size for morbidity in the youngest age band because it is these

less experienced women who are most reliant on female alloparents for advice and help related to childbearing and childrearing.

2.9.2 Putative mechanisms

It is then possible that people have evolved psychological mechanisms which detect morbidity as well as mortality in the locale, which is unsurprising as, although chronic, non-communicable diseases are now most prevalent (Olshansky & Ault, 1986), throughout human history there would have been many indicators of communicable illness, usually leading to death. The mortality/morbidity 'age flip' suggests that at around age 25 in this particular context, local cues to premature death and elevated ill-health (presumably transmitted visually and via word-of-mouth) stop eliciting the motivation to take a pregnancy to motherhood; and instead start motivating women to terminate pregnancy. In terms of evolved psychological mechanisms, this suggests that the same informational input from the ecology is leading to different behavioural outcomes at different ages. Additional information feeding into such a decision might be both an assessment of the woman's own personal state of health, which is probably more likely to be impaired if she lives in a deprived environment (notwithstanding the ecological fallacy); and the achieved parity of the woman so far. Indeed, accelerated health deterioration and early childbearing have been found to co-occur in a cohort of British women, and the former does not appear to be a consequence of the latter (Nettle, 2014). Gray, Evans and Reimondos (2013) find that even for childless women a decline in health from fair to poor is associated with a decrease in childbearing desires, as is an increase in age; and with age individual morbidity becomes more likely.

The small effect sizes for mortality, once other indicators of deprivation are controlled, might indicate that other ecological indicators of deprivation act as proxies for shortened life expectancy. If individuals in the neighbourhood are living in social rented housing, have a low income, do not choose to acquire a tertiary education, and are unemployed, it might be that these cues are computed as proxies for short life expectancy without explicit cues of mortality

(e.g. violent crime) being present. The generally small effect sizes are in some ways unsurprising, as there are many contributing factors to the decision to have an abortion. If the effect of mortality or morbidity were greater, the putative phenomenon would no doubt be consciously perceived and widely recognised.

2.9.3 Deprivation-related controls

The regression results also indicate that the socioeconomic variables mostly have a consistent direction of relationship to AP across the age bands. Therefore this analysis does not simply indicate that 'deprived people have children earlier'. When one uses a modest number of measures to disaggregate different aspects of area-level deprivation, we can see that that while, for example, unemployment associates consistently with higher levels of abortion across age bands, other variables, including health, education and proportion of population in owned housing associate with AP in an age-varying way, all else equal. Therefore the results are mixed regarding the association between AP and deprivation depending on the measures used. Our results suggest that deprivation matters over and above either mortality or morbidity risk, which in turn suggests that deprivation is an indicator of more than just health risks.

Education changes from being a positive predictor of AP for the younger two age bands to a negative predictor for the older two age bands – clearly a description of the time trade-off between education and reproduction. Mortality and morbidity schedules might represent an ultimate time horizon determining reproductive timing and thereby secondary decisions related to accrual of embodied capital. We see that high-mortality/morbidity wards show low under-25 AP while high-education wards see high under-25 AP. LE has a Spearman correlation of .44 with the education variable, while LTLI has one of -.67. High mortality/morbidity indicates low education and low AP, consistent with the idea that perceived health/lifespan could affect early reproductive scheduling and thereby education decisions. McLanahan (2004) shows that in the most developed countries life trajectories between the most-educated and least-educated women have drastically diverged in recent decades, meaning increasing inequality in resources (e.g. wealth; presence of an investing father) for their offspring. Although she speculates on four causes, i.e. feminism, new

birth control technologies (including the Pill and abortion); changes in the labour market; and welfare policies, this does not fully explain why becoming educated is of differential interest to women of different socioeconomic backgrounds in the first place. This could be explained by differential time horizons from unequal mortality/morbidity cues. However, direction of causality (if any) between ward-level mortality/morbidity, under-25 AP, and ward-level education is not known. It is equally possible that perceived individual returns to education might affect reproductive scheduling; and some public health literature discusses the possible causal role education plays in health (Lynch, 2003; Schillinger, Barton, Karter, Wang, & Adler, 2006).

2.9.4 Limitations

There are some limitations to our study. A ward measure of 'access to services' (distance from a post office; food shops; a GP; a primary school) was unavailable for this time period. There is some overlap in its content and those measuring provision of contraception and abortion services, in that initial consultation with a GP is a route to abortion referral. However, specific abortion provision (referral, consultation and procedure) has not been associated with AP, although the percentage of female GPs in a local authority was predictive in final models of one study (Lee et al., 2004). In general, therefore, there is no strong reason to think that access to services might especially influence AP.

The ecological fallacy means that any apparent relationship between mortality/morbidity and AP should be cautiously appraised because those experiencing the average ward level of mortality/morbidity might not be those who are choosing whether to terminate a pregnancy while residing there. However, the theoretical underpinning of this paper means that we assume women are picking up not only their own experience of death or disease, but also area-level cues indicating actual or likely death or disease in both loved ones (to gauge their availability for childcare) and strangers (to gauge general safety). Cues to mortality might assay the prevalence of violent street crime, with young males more often homicide victims (Statistics, 2013). These cues might be discounted by a young pregnant woman who does not feel that her future holds the possibility of moving to a 'better' area; and who might have nearby family offering childrearing support such that paternal investment from

a reliable male is not crucial. Morbidity itself might be more likely to affect the young woman herself, or potential caretakers for offspring like female friends or relatives. It is not necessary for our hypothesis, then, that those making reproductive decisions are exactly the same individuals experiencing death or disease. Therefore the concerns raised by ecological fallacy are here somewhat mitigated; and the relatively small size of wards also helps.

What we can say about how conditions in an individual's residential ward might affect their reproductive behaviour remains partial, nevertheless. People's day-to-day geographical mobility (e.g. for work) means that they might not be affected by mortality/morbidity cues close to home, and the extent of this might also vary with socioeconomic status. Wards also might not be coterminous with the area people experience as their neighbourhood. Additionally, if someone moves house between learning of a pregnancy and starting/continuing a family, it could be said that the initial cues might not be at a consistent level to those in the new residential ward where the birth occurs. Yet as there is low social mobility in the UK within and between generations (Hills et al., 2010) individuals are likely to move to areas with similar deprivation and health levels.

The AP variable offers no information regarding parity; the lack of raw numerators and denominators means one must necessarily compare wards with low and high conception base rates; and the cross-sectional nature of the data mean that causality cannot be inferred.

2.9.5 Final summary

In summary, mortality has small but consistent effects in predicting abortion proportion across age bands: lower in under-25s (in line with life history theory predictions), consistent with a role in stimulating early fertility; and higher in older age bands. Elevated morbidity predicts lower under-25 abortion proportion with a large effect size, consistent with the weathering hypothesis and possibly indicating its greater salience for reproductive aged women in low-mortality societies. It also has small effects on intermediate age bands' AP, with poor ward-level health predicting more abortion. However, it has no relationship with AP in women 35 and over, which may point to greater concerns with potential offspring health at this point in the lifespan. Future

research should explore individual-level psychological mechanisms mediating any assumed causation.

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Student	SANDRA VIRGO
Principal Supervisor	DR. REBECCA SEAR
Thesis Title	Are risk of mortality and morbidity determinants of abortion behaviour and attitudes in England & Wales?

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?	
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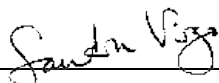
SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	EVOLUTIONARY PSYCHOLOGY
Please list the paper's authors in the intended authorship order:	SANDRA VIRGO, REBECCA SEAR
Stage of publication	PRE-SUBMISSION

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Sandra Virgo was responsible for designing this study, conducting it, analysing the data and writing up results. Rebecca Sear supervised the study and contributed to writing up the paper.
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Student Signature: _____



Date: 28/09/2015

Supervisor Signature: _____

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Chapter 3 Does mortality salience cause strategic morality? Death/longevity priming and abortion attitudes

Experiments show that when mortality is made psychologically salient, participants express greater desire to have children; an earlier age at first birth; a higher ideal number of children; and greater disapproval of birth control policies. Drawing on life history theory, it has been hypothesised that such results may indicate an evolved psychological mechanism leading to pro-natalism where mortality is high. Here we conceptualise abortion attitudes as a component of reproductive decision-making, which are predicted to become less approving in the face of mortality priming in our English/Welsh population of unmarried childless 18-25-year-olds. The conceptual opposite, longevity salience, is also tested to determine whether it leads to increased approval of abortion compared to controls. Abortion approval is measured in both general and personal terms. Under Mortality Salience the overall trend is for men to become less approving of abortion and more interested in early parenthood; and for women to become less approving of abortion when judging a hypothetical woman, but actually more approving of abortion on a personal level and less interested in imminent parenthood. Under Longevity Salience the trends are for men to become more approving of abortion, but more interested in early parenthood; and for women to become less approving of abortion, but less interested in imminent parenthood. However, the only statistically significant result ($p=0.012$) was women's becoming less approving of abortion when judging a hypothetical woman under Longevity Salience, a result which was contrary to predictions. This was not associated with a significant shift in subjective life expectancy. Although Mortality Salience meant significantly reduced subjective life expectancy in men there was no corresponding significant shift in any reproductive motivation.

3.1 Introduction

3.1.1 Theoretical background

In behavioural ecology research, it has been found that local mortality rates predict reproductive strategy, such that high mortality is associated with earlier reproductive age in a 'fast' life history strategy, and higher overall fertility. 'Slower' life histories occur in low mortality/less risky environments (Charnov, 1991). Life histories can diverge between species (Promislow & Harvey, 1990) and within species (Reznick et al., 1990); and are not necessarily governed by conscious decision-making (Engqvist & Sauer, 2002; Javois & Tammaru, 2004). There is evidence across small-scale, developing and developed human societies that high mortality and/or low life expectancy is related to earlier age at menarche and earlier reproduction (B S Low et al., 2008; Walker et al., 2006),

although where life expectancy changes rapidly the relationship is not necessarily at equilibrium (Bobbi S Low, Parker, Hazel, & Welch, 2013) and there is a lack of evidence regarding whether this actually results in higher lifetime individual fertility. Thought to mediate these associations are adaptations which can happen over evolutionary time (Migliano et al., 2007); or within a lifespan environmental cues can influence an organism's phenotype via evolved adaptive physiological and psychological mechanisms (Del Giudice & Belsky, 2011; Nettle, 2010b). As long as individuals are receiving enough calories to be fertile, mortality is therefore expected to influence reproductive scheduling (Belsky et al., 2012).

3.1.2 The usefulness of experimental research

Most of the research into associations between mortality and fertility levels and/or timing in humans uses observational data (Cohan & Cole, 2002; Geronimus et al., 1999; Guegan et al., 2001; Heuveline & Poch, 2007; K. Hill & Hurtado, 1996; B S Low et al., 2008; Nettle, 2010a; Pickett et al., 2005; Rodgers et al., 2005; M. Wilson & Daly, 1997), and much of the work uses measures of low socioeconomic status as a proxy for a mortality measure as it is well established that deprivation is strongly related to shorter life expectancy (Woods et al., 2005). Observational studies produce valuable information, but suffer from the problem common to such studies that it can be difficult to exclude confounding factors and be confident that correlations between mortality risk and fertility are causal. Psychological methods can therefore be useful in supplementing such studies and determining whether the associations found can be said to be causally related. Some studies have already been performed using random assignment and experimental manipulation to uncover

putative mediating mental mechanisms linking mortality with fertility. These experiments and other psychological mechanisms of reproductive motivation were reviewed by the author and her colleague, Lisa McAllister, for The National Evolutionary Synthesis Center (NESCent). The report can be found in Appendix A of this thesis, as well as a co-authored submission to *Philosophical Transactions of the Royal Society B*, 'Psychological Mechanisms of Fertility Behavior: Hunting for Causation in a Sea of Correlation'.

3.1.3 Mortality salience experiments

Life history theorists have been especially interested in experiments where primes used to make mortality psychologically salient in the treatment group evince both self-reported and implicit preference for children, higher ideal number of children, desire for children sooner, and greater disapproval of birth control policies (Fritsche et al., 2007; Griskevicius et al., 2011; Mathews & Sear, 2008; Taubman-Ben-Ari & Katz-Ben-Ami, 2008; Wisman & Goldenberg, 2005; Yaakobi et al., 2014; Zhou et al., 2009; Zhou et al., 2008). More implicit measures like time spent looking at photos of children and maternal separation anxiety also increase. These experiments seem to indicate that reminders of death mean significantly pro-natal responses. However, these results are sometimes confined to men, and anti-natal responses have been seen under Mortality Salience in women, which were only reversed by reassurances that career and childrearing are compatible (Mathews & Sear, 2008; Wisman & Goldenberg, 2005). Such sex differences are probably related to the higher cost (physical, emotional and professional) of having children for women. Other studies have not found sex differences (Fritsche et al., 2007), perhaps because

they have used more modest dependent variables than ‘ideal number of children’, but instead asked if people would like ‘at least one child’, which even in a low-fertility context is still attained by the vast majority of people. One experiment done by researchers with an interest in life history theory (Griskevicius et al., 2011) discovered that after mortality priming, participants reared in a relatively socioeconomically deprived environment reported greater interest in imminent parenthood; and those reared in a relatively wealthy environment had less interest in imminent parenthood. Unlike the other experiments, there were no main effects of treatment condition. Instead there seems to be evidence that fast and slow life history strategies map onto levels of socioeconomic deprivation in some way, which implies that there is an evolutionary rationale behind observed differences in commencement of fertility in developed societies. It implies that it is in a harsh or unpredictable environment (simulated by mortality priming) where developmentally calibrated differences created in childhood come to light. The increased pro-natalism shown in these experiments overall appears to be a reliable effect, although we do not know if they were the subject of publication bias, the tendency for journals to only publish positive results; or how many further replications have even been attempted. Equally, even if the effects shown in these experiments are reliable, it is unclear whether mortality salience has similarly pro-natal effects in the real world where they might pale into insignificance beside other influences in reproductive motivation e.g. supportive parents; promising finances, etc.

3.1.4 Abortion attitudes

Given that Zhou et al. (2008) discovered that mortality salience made people disapprove more of China's one-child policy, it seems that perhaps these pro-natal effects might generalise more widely into other measures. The current study tests whether, if mortality salience could have these effects on fertility desires, they could also have an effect on abortion attitudes. Abortion is widely used as a means of controlling reproductive scheduling and family size. As Hrdy (1979) argues, terminating investment in an offspring may be adaptive where it increases maternal survival or either parent's future reproductive success. The relatively high cost of human infants means it occurs frequently (Hrdy, 2009), and in small-scale societies there have long been methods used to facilitate abortion using herbal preparations (Jain, Katewa, Chaudhary, & Galav, 2004). In contexts where the technology exists for it to be medically safe as well as available and legal, it is even more common, and can therefore be seen as a key component of reproductive behaviour. For example, more than 185,000 procedures were performed on women resident in England and Wales in 2013 (Department of Health). Abortion has previously been considered within an evolutionary framework as one means of regulating reproductive output (E. M. Hill & Low, 1992; Lycett & Dunbar, 1999). We have previously shown in Chapter Two that area-level mortality and morbidity rates are correlated with abortions in England and Wales: lower mortality predicts higher levels of abortion for women aged under 25, suggesting that abortion may be used as a reproductive scheduling strategy to delay births in environments where this may be beneficial and has few costs. From previous research and from life history theory, one would then predict that mortality salience might make people less approving of abortion.

Certainly there is ample observational and qualitative research indicating that in the United Kingdom, more deprived young people are more disapproving of abortion (Burghes, 1999; Jewell et al., 2000; Lee et al., 2004; Thomson, 2000; Turner, 2004), though it is not known whether these socioeconomic differences relate to local mortality or morbidity rates. The 'weathering hypothesis' (Geronimus, 1996b) postulates that young deprived women consciously think of their own likely short lifespan and uncertain health (based on those around them) when timing fertility. The current research aims to determine whether mortality salience (and its conceptual opposite, longevity salience) can affect abortion attitudes in a controlled psychological experiment among 18-25-year-old unmarried childless people in England and Wales.

3.1.5 Mortality salience experiments: Terror Management Theory

Previous psychological research investigating the effect of mortality salience on fertility desires were initially experiments inspired by Terror Management (TMT) theory, which says that as humans are the only animal conscious of their own impending death, psychological strategies are used to buffer the stress created by this realisation, including becoming closer to one's in-group; defending more strongly one's personal worldview; and desiring offspring more. Although esoteric-sounding to most evolutionary behavioural scientists, both terror management theorists and life history theorists have considered the potential compatibility of the two outlooks (Fritsche et al., 2007; Griskevicius et al., 2011; Landau, Solomon, Pyszczynski, & Greenberg, 2007; Wisman & Goldenberg, 2005). It is likely that the fact that mortality salience experiments can also produce outcomes other than increased pro-natalism is simply an indicator of human symbolic ability in terms of derived relations (Barnes-

Holmes, Hayes, Barnes-Holmes, & Roche, 2002). Literal genetic immortality is achieved only by reproduction. However, other desires stimulated by mortality priming are unsurprising: in-group belonging and having high status/influential opinions would have been proxies for both individual survival and reproduction but also the likely survival, thriving and reproduction of one's offspring ancestrally. The TMT literature sometimes emphasises the notion of offspring as succour for death anxiety provoked by mortality priming which is also unsurprising, simply indicating that there are two-way relationships between ideas in the psyche, and also given the fact that in many human societies children have provided their parents with economic security.

The first Terror Management Theory paper to link mortality salience and fertility desires was by Wisman & Goldenberg (2005), who found in four experiments that mortality salience triggered a desire for a greater number of offspring in men when compared to a control group, while females in the treatment group showed a trend for wanting fewer. The sex difference seemed to be the result of perceived tradeoffs between children and career, as when women were asked to read an article stating that career and motherhood were compatible, the sex difference disappeared, and this effect was driven by females previously assessed as valuing career highly relative to family. As in most mortality salience experiments, participants in the treatment condition were asked to write about what would happen to them physically and emotionally during their own death, and to describe their emotions. Fritsche et al. (2007) found that following a mortality salience prime, both sexes were more likely to say they would like at least one child compared to controls, as well as indicating a stronger desire for children on a composite measure, and used more death-

related words in a language task. Zhou et al. (2008) in China found that participants primed with death via a word-completion task disapproved more of China's one-child policy. In a second study they found that hospital inpatients preferred family members under 5 to older family members; and that patients with terminal cancer preferred them more than patients without. Further work (Zhou et al., 2009) showed that undergraduates asked to consider their own death viewed pictures of children under 5 for longer than controls and were more likely to select pictures of these (versus pictures of adults/objects) as their favourites of the set. People reading a bogus news story including the deaths of two babies had a shorter subjective life expectancy compared to those reading the same story but involving only adult deaths. In an Israeli study, priming mortality salience induced higher maternal separation anxiety in first-time mothers of babies aged 3-12 months (Taubman-Ben-Ari & Katz-Ben-Ami, 2008). Yaakobi et al. (2014) found that mortality salience made parenthood more important to people, and parenthood-related thoughts were more vivid (both assessed with questionnaires) compared to control conditions. Reaction times showed that parenthood-related thoughts were more accessible for the mortality salience group than controls.

3.1.6 Mortality salience and life history theory

Researchers using evolutionary life history theory independently developed similar mortality priming work. Mathews & Sear (2008) discovered that, following the prime of a bogus mortality quiz administered online, males (but not females) had a higher ideal number of children. The effect was increased when males who wished to remain childless were removed. There was also a non-significant trend in both sexes for children to be perceived as being less

costly. The sex difference was here interpreted as being due to the differential cost of children for the two sexes (Trivers, 1972), meaning that male responses to mortality salience are more flexible. Griskevicius et al. (2011) did a series of experiments using bogus newspaper articles about increasing shootings and random deaths to prime a harsh and unpredictable environment. They found a moderating effect of subjective childhood socioeconomic status, whereby following the treatment, participants who reported subjective childhood poverty reported a desire to have children now even at the cost of furthering education or career. For those reporting subjective childhood wealth, mortality primes made them say they wanted to delay reproduction to focus on education or career. With no differences between reported life history strategy in controls, the authors say that divergence here must be specifically activated by the unpredictable and harsh environment that the mortality cues primed, with an individual's history calibrating how to respond in the face of these in terms of whether they are perceived as intrinsic (avoidable through increased self-investment), which correlates with slow strategy; or extrinsic (unavoidable/random) which correlates with a fast strategy. However, it is already known from observational studies that childhood socioeconomic environment relates to age at first birth, regardless of mortality cues. Griskevicius et al. (2011) had a control group which did not diverge socioeconomically in terms of reported life history strategy, which could be because it was insufficiently socioeconomically varied, being comprised only of college students; or, as the authors suggest, because those with a wealthier background may have had larger energy budgets mitigating trade-offs between growth and reproduction, thus enabling earlier reproduction among these individuals. Still, it is not necessarily true that among US college students the

relatively poor participants would have had smaller energy budgets. Therefore it is unclear what moderating effects we might expect socioeconomic status to have in mortality priming experiments focusing on reproductive outcomes.

3.1.7 Psychological mechanisms

Theoretically speaking, there are multiple likely proximate mechanisms underlying fertility variation between individuals. These include developmental induction where early-life inputs trigger specific adult phenotypes; social learning from observing and/or copying others leading to locally adaptive behaviour; contextual evocation where evolved psychological mechanisms respond to local cues to produce an appropriate response; genetic polymorphisms where heritable influences operate within isolated populations as well as gene/environment interactions; and higher-order cognitive processes of deliberation and planning (Nettle, 2011). According to Nettle's classification, the influence of mortality-related ecological cues during adulthood would come into the category of contextual evocation; and in evolutionary psychological terms would account for cultural and sub-cultural differences in social norms regarding fertility and abortion in the form of 'evoked culture' (Gangestad, Hasleton, & Buss, 2006). The latent calibration of reproductive strategy during childhood as mooted by Griscevicius et al. (2011) in the experimental work described earlier would be developmental induction. In actual fertility decision-making in real life, the other mechanisms described undoubtedly play a part, and will co-exist and interact.

Particularly in the decision regarding whether to have an abortion once pregnant, it is likely that local social norms and also higher-order cognitive processes play strong roles, as the emotional and financial cost of having a child

is high, and humans often make use of alloparents (Hrdy, 2009). Even in the developed world, as described earlier, there are (sub)cultures where abortion carries a stigma, and therefore it is extremely unlikely that the decision whether or not to continue a pregnancy is ever devoid of a high level of deliberative thinking. In the real world, there may be inaccurate perception of mortality risk due to cognitive biases (Montgomery, 2000); and fertility preferences do not necessarily map onto actualised fertility, as argued by demographers (Berrington, 2004; Smallwood & Jefferies, 2003).

3.1.8 The current experiment

In the current research, it is only present contextual evocation (via priming) of self-reported attitudes to abortion (both pertaining to others and the self) and desire for parenthood that are investigated, in order to make the experiment as 'clean' as possible and to rule out confounding factors as the relationship between mortality and fertility is undoubtedly complex. We also look at whether there is moderation of any effects by childhood and adult socioeconomic status (possible developmental induction). Nevertheless, it is of interest to see whether ecological cues, especially those which may be associated with deprivation, might inform attitudes to abortion, a morally charged and oft-politicised topic. We also investigate attitudes to early parenthood following priming, as in the research by Griscevicius et al. (2011), because abortion appears to be used as a means of managing age at first birth.

3.1.9 Hypotheses for the experiment

In the mortality priming condition, compared to the control condition:

1. Participants are expected to show lower approval of abortion.
2. Participants are expected to show greater interest in early parenthood.

In the longevity priming condition, compared to the control condition:

1. Participants are expected to show higher approval of abortion.
2. Participants are expected to show less interest in early parenthood.

As neither sex differences in treatment effects nor interactions with socioeconomic status are consistent in the previous research, there are no hypotheses regarding these, but they are investigated.

Additionally, the effect of the experimental conditions on Subjective Life Expectancy were investigated, partly as a manipulation check and also to see if any experimental effects were mediated by subjectively shorter or longer life expectancy as we would expect from life history theory reasoning.

3.2 Method

Before the experiment commenced, approval was sought from and granted by the ethics committee of London School of Hygiene & Tropical Medicine.

3.2.1 Participants

Participants were recruited via the Crowdfunder website, a crowdsourcing site which places links to consumer and academic surveys on websites where people go to perform small 'microtasks' in return for remuneration. Upon clicking the link participants were then routed to the SocialSci survey platform, where the experiment was hosted. Before the start of the experiment, screening questions ensured that all participants taking part were aged 18-25, unmarried, childless, had grown up in England or Wales, and were currently living in England or Wales. These criteria were chosen in order to be comparable with demographic data in related research, and also to capture people who were

likely to be at the beginning of their reproductive lives. For ethical reasons due to the nature of the experimental stimuli, people were also screened out if they had been recently bereaved, if they suffered from a life-threatening illness, were currently or recently pregnant, or had a partner currently or recently pregnant.

Online recruitment was used for ease of data collection; to minimise social desirability or experimenter bias regarding the nature of the topics discussed; and to garner a more socioeconomically varied sample than is usually attained by using undergraduates, given that outcomes may be moderated by socioeconomic status as described earlier. As Henrich et al. (2010) make clear, even within developed countries there is variation in the social, economic and demographic dimensions which might make university undergraduates highly unusual in terms of their outcomes in behavioural science. Indeed, Haidt et al. (1993) found differences between socioeconomic groups in moral reasoning both in Brazil and the US, with college students at elite universities taking a more relativistic stance than other participants. A small number of participants were excluded from the current study when it became apparent that they had taken part more than once, apparent from their residential postcodes and demographic information.

3.2.2 Design and procedure

Participants were first told that they would be answering some questions regarding abortion attitudes and parenthood and might also be asked about their general knowledge and attitudes on various other topics prior to this.

Following the screening described above, they were then exposed to the primes, each being randomly assigned to one of the three between-subjects prime conditions, stimuli for which can be seen in Appendix C.

I. Mortality Salience (MS)

The MS prime was a bogus quiz including questions on mortality statistics and also personal attitudes towards death. It was decided to have a prime in this format as the experiment was being administered online. Following the ethical guidelines of the British Psychological Society (BPS, 2007, 2010) it is important that participants do not experience stimuli which could more distress than might be encountered in everyday life, particularly in online research where a face-to-face debrief is impossible. Of all the mortality primes used in previous related research, it was felt that the bogus quiz (Mathews & Sear, 2008) was least likely to cause distress to vulnerable participants as when research is online there is only the chance for a written debrief rather than face-to-face.

1. Longevity salience (LS)

The LS prime was included as the conceptual opposite to the mortality prime: if participants were expected to have greater anti-abortion attitudes when reminded of death, then when made to think about having a long, healthy life they should have more pro-abortion attitudes than controls. This prime was also a bogus quiz, with identically formatted questions to the mortality prime, but with the topic of healthy old age and increasing lifespans.

2. 'Lost property' control (LPC)

The LPC was a bogus quiz asking questions about lost property statistics and attitudes towards losing things. It was conceived of as a mildly aversive stimulus following the same format as the other primes while adhering to the necessary ethical standards. In terms of content it was similar to the control used by Griskevicius et al. (2011) where a newspaper story about lost keys was used.

Mortality salience experiments following the TMT perspective often use a filler task between prime and dependent measures as it is thought that treatment effects depend on individuals no longer consciously attending to death-related thoughts (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994). However, those from a life history theory perspective (Griskevicius et al., 2011; Mathews & Sear, 2008) have found effects without these, and so they were also omitted here.

3.2.3 Dependent measures

Personal abortion questions: At this point, participants were presented with personal questions on abortion, having been told there were no right or wrong answers. Females were asked, 'if you discovered you were pregnant now, would you have an abortion?' Males were asked, 'if you had a girlfriend who discovered now that she was pregnant by you, do you think she should have an abortion?' In both cases responses were chosen on a seven-point semantic differential scale from 'definitely no' to 'definitely yes' at the two ends.

Early Parenthood Approval Scale: Identical to Griskevicius et al. (2011), attitudes to this were assessed with three items:

- 1) Would you like to have children in the next few years? (Responses ranging on a five-point scale from 'definitely no' to 'definitely yes')
- 2) If you were to have a child in the next few years, how would you feel? (Responses ranging on a five-point scale from 'feel negative' to 'feel positive')
- 3) How disappointed would you be if you did NOT have a child in the next few years? (Reverse scored, with responses on a five-point scale from 'not at all disappointed' to 'very disappointed')

A composite standardised score for attitudes to early parenthood was created by averaging the scores for each participant among those who had answered all three questions. Its internal reliability meant a Cronbach's alpha of .86.

Next participants were told 'there are certain circumstances in which a woman might consider having an abortion. Please say in each of the following cases whether you think it would be acceptable, unacceptable, or somewhere in between for the woman to have an abortion. You can do this by selecting one of the points on the scale'.

General abortion attitudes questions: Then followed ten questions indicating potential scenarios, e.g. 'continuing the pregnancy would severely harm the woman's health'; 'the woman decides she does not have enough money to support a child'; 'the woman simply doesn't want to have a child (the reason doesn't matter)'. Responses to each item were made on a seven-point semantic differential scale ranging from 'abortion is unacceptable' to 'abortion is acceptable', with some items presenting the response scale in the reverse direction to guard against responses being given on 'automatic pilot'.

These were presented in randomised order to avoid fatigue effects. The full list of scenarios is presented in Appendix C. A composite standardised abortion attitudes score was created by averaging the score for all those participants who answered all ten items. Internal reliability of the score gave a Cronbach's alpha of .84.

Subjective life expectancy: Next participants were asked, 'if you had to take a guess about what age you will be when you die, what would you say?' This item was included for several reasons. Firstly it acted as a manipulation check to determine whether the treatment has had the anticipated effect on participants, i.e. the mortality salience prime should reduce people's perception of their own life expectancy compared to controls; while longevity salience should increase it. Reduced subjective life expectancy (SLE) should then, in terms of Life History

Theory's assumptions, be associated with decreased abortion approval while increased SLE should mean higher abortion approval. SLE's inclusion can also make sure that the manipulation has construct validity. It has been found in previous research inspired by Life History Theory to be associated with fertility-related outcomes related to environmental quality and/or maternal condition (Johns, 2004), both conceptually related to mortality rates.

3.2.4 Other measures

Demographic questions: People were then asked a number of demographic questions, in order to check that random assignment worked to distribute participants with background characteristics such that they did not vary systematically between experimental conditions. These questions were on cohabitation status; ethnicity; religion; religiosity; and with whom participants mostly lived until age 12, (results for which were collapsed into two categories – either 'with biological parents' or 'other'). They can be seen in Appendix C.

Objective childhood/adult socioeconomic status (measured with questions on job status/education of participants and their parents) were also assessed. Subjective childhood and current subjective socioeconomic measures were identical to those used by Griscevicius et al. (2011). The items for subjective childhood socioeconomic status were: (a) "My family usually had enough money for things when I was growing up"; (b) "I grew up in a relatively wealthy neighborhood"; (c) "I felt relatively wealthy compared to the other kids in my school."

Subjective current/future socioeconomic status was assessed with the following items:

(a) “I have enough money to buy things I want”; (b) “I don’t worry too much about paying my bills”; (c) “I don’t think I’ll have to worry about money too much in the future.”

From this prior mortality salience research, it can be seen that these measures may potentially moderate treatment effects.

Participants were additionally asked their age at sexual debut; whether generally they prefer a romantic partner with a high level of education; and whether, if they have a sister/sisters, she does or has done well at school. These were asked not only because some of them (e.g. age at sexual debut) might act as potential confounders, but also because Weeden (2003) found them predictive of abortion attitudes in his behavioural ecology analysis hypothesising that people’s reproductive interests and life history strategies in a modern developed world context of non-reproductive sex, higher education and women’s participation in the labour market would be predictive of abortion attitudes. He found that in a US sample of Penn undergraduates, those who were more pro-choice regarding abortion had either no sisters or a sister who was expected to become highly educated; and also were more likely to want an educated spouse. He also found that in a middle-aged sample of Harvard graduates, in the Penn sample and in a middle-aged General Social Survey sample that people were more pro-choice if they had been younger when they had first had sex (or had had a long period before first sex and reproduction). Therefore these were included as background demographic variables.

At the end of the questionnaire, in line with ethical standards (BPS, 2007, 2010), participants were debriefed as to the experimental nature of the research, and were told of its background and aims.

3.3 Results

3.3.1 Summary statistics for participants

After exclusion of a few participants who had done the questionnaire more than once, 471 participants remained (213 males and 258 females) with a mean age of 21.62 (SD 2.19). Their key background features across the three conditions can be seen in Table 3.1.

Table 3.1: selected background demographics of participants across conditions. (Except for total number the percentage figure relates to distribution within each treatment group.) Percentages are rounded to the nearest integer, and for continuous variables means are used.

CONDITION	MORTALITY SALIENCE	LONGEVITY SALIENCE	LOST PROPERTY CONTROL
Total	Total = 165 (35% of sample)	Total = 150 (32% of sample)	Total = 156 (33% of sample)
Sex	Male=76 (46%) Female=89 (54%)	Male=68 (45%) Female=82 (55%)	Male=69 (44%) Female=87 (56%)
Age (years)	Mean = 21.55	Mean = 21.64	Mean = 21.69
Current Country	England=151 (92%) Wales=14 (8%)	England=142 (94%) Wales=9 (6%)	England=147 (94%) Wales=9 (6%)
Childhood Country	England=152 (92%) Wales=13 (8%)	England=144 (95%) Wales=7 (5%)	England=150 (96%) Wales=6 (4%)
Ethnicity	White British=125 (76%) White Irish=4 (2%) White Other=9 (5%) Mixed White and Black Caribbean=2 (1%) Mixed White and Black African=1 (1%) Mixed White and Asian=1 (1%) Any other mixed background=3 (2%) Asian/Asian British Indian=4 (2%) Asian/Asian British Pakistani=6 (4%) Asian/Asian British Bangladeshi=2 (1%) Any other Asian background=2 (1%) Black/Black British Caribbean=0 (0%) Black/Black British African=1 (1%) Chinese=1 (1%) Any other ethnic group=0 (0%) Prefer not to say=4 (2%)	White British=112 (74%) White Irish=4 (3%) White Other=3 (2%) Mixed White and Black Caribbean=3 (2%) Mixed White and Black African=1 (1%) Mixed White and Asian=5 (3%) Any other mixed background=0 (0%) Asian/Asian British Indian=5 (3%) Asian/Asian British Pakistani=5 (3%) Asian/Asian British Bangladeshi=2 (1%) Any other Asian background=0 (0%) Black/Black British Caribbean=1 (1%) Black/Black British African=3 (2%) Chinese=1 (1%) Any other ethnic group=1 (1%) Prefer not to say =5 (3%)	White British=122 (78%) White Irish=2 (1%) White Other=7 (4%) Mixed White and Black Caribbean=1 (1%) Mixed White and Black African=1 (1%) Mixed White and Asian=3 (2%) Any other mixed background=1 (1%) Asian/Asian British Indian=3 (2%) Asian/Asian British Pakistani=3 (2%) Asian/Asian British Bangladeshi=0 (0%) Any other Asian background=2 (1%) Black/Black British Caribbean=0 (0%) Black/Black British African=2 (1%) Chinese=1 (1%) Any other ethnic group=1 (1%) Prefer not to say =7 (4%)
Do you have religious beliefs?	No=116 (70%) Yes=37 (22%) Prefer not to say =12 (7%)	No=98 (65%) Yes=49 (32%) Prefer not to say =4 (3%)	No=108 (69%) Yes=41 (26%) Prefer not to say =7 (4%)
Religion	Prefer not to answer=3 (2%) Christian=28 (17%) Muslim=10 (6%) Hindu=0 (0%) Sikh=1 (1%) Jewish=0(0%) Buddhist=1(1%) Other (includes other; agnostic; believe in god but don't practice any religion; spiritual and deeply interested in all religions; evolutionist; heavy metal; spiritualist; pagan)= 2 (1%) Missing=120 (73%)	Prefer not to answer=6 (4%) Christian=29 (19%) Muslim=11 (7%) Hindu=1 (1%) Sikh=1 (1%) Jewish=0 (0%) Buddhist=0 (0%) Other (includes other; agnostic; believe in god but don't practice any religion; spiritual and deeply interested in all religions; evolutionist; heavy metal; spiritualist; pagan) =4 (3%) Missing=99 (66%)	Prefer not to answer=4 (3%) Christian=29 (19%) Muslim=4 (3%) Hindu=4 (3%) Sikh=1 (1%) Jewish=2 (1%) Buddhist=0 (0%) Other (includes other; agnostic; believe in god but don't practice any religion; spiritual and deeply interested in all religions; evolutionist; heavy metal; spiritualist; pagan)= 2 (1%) Missing=110 (71%)

CONDITION	MORTALITY SALIENCE	LONGEVITY SALIENCE	LOST PROPERTY CONTROL
Strength of religious beliefs	1 Very weak =2 (1%) 2=7 (4%) 3=17 (10%) 4=8 (5%) 5 Very strong =9 (5%) Missing=122 (74%)	1 Very weak =2 (1%) 2=6 (4%) 3=17 (11%) 4=15 (10%) 5 Very strong =8 (5%) Missing=103 (68%)	1 Very weak =4 (3%) 2=5 (3%) 3=19 (12%) 4=9 (6%) 5 Very strong =7 (4%) Missing=112 (72%)
Cohabiting	No=107 (65%) Yes=58 (35%) Missing=0(0%)	No=100 (66%) Yes=51 (34%) Missing=0(0%)	No=103 (66%) Yes=53 (34%) Missing=0 (0%)
Current job type	Student=63 (38%) Unemployed=24 (15%) Unskilled manual=16 (10%) Skilled manual=18 (11%) Clerical = 25 (15%) Professional = 18 (11%) Missing=1 (1%)	Student=62 (41%) Unemployed=16 (11%) Unskilled manual=13 (9%) Skilled manual=10 (7%) Clerical = 22 (15%) Professional = 22 (15%) Missing=6 (4%)	Student=57 (37%) Unemployed=15 (10%) Unskilled manual=16 (10%) Skilled manual=6 (4%) Clerical = 26 (17%) Professional = 27 (17%) Missing=9 (6%)
Current highest qualification	No qualifications=4 (2%) Less than 5 GCSEs A-C grade = 10 (6%) 5 or more GCSEs A-C grade =21 (13%) Foundation degree or NVQ Level 4 or 5 = 7 (4%) AS-level, A-level, Access course = 56 (34%) Bachelor's degree or teaching qualification = 50 (30%) Master's degree = 9 (5%) Doctorate = 1 (1%) Missing =7 (4%)	No qualifications=1 (1%) Less than 5 GCSEs A-C grade = 5 (3%) 5 or more GCSEs A-C grade = 14 (9%) Foundation degree or NVQ Level 4 or 5 = 12 (8%) AS-level, A-level, Access course = 58 (38%) Bachelor's degree or teaching qualification = 40 (26%) Master's degree = 8 (5%) Doctorate = 0 (0%) Missing =13 (9%)	No qualifications=2 (1%) Less than 5 GCSEs A-C grade =11 (7%) 5 or more GCSEs A-C grade =16 (10%) Foundation degree or NVQ Level 4 or 5 = 4 (3%) AS-level, A-level, Access course = 60 (38%) Bachelor's degree or teaching qualification = 44 (28%) Master's degree = 11 (7%) Doctorate = 2 (1%) Missing =6 (4%)
Highest-paid job of highest-earning parent up to age 12	Unemployed = 5 (3%) Unskilled manual = 20 (12%) Skilled manual = 39 (24%) Clerical = 16 (10%) Professional = 72 (44%) Missing = 13 (8%)	Unemployed = 3 (2%) Unskilled manual = 12 (8%) Skilled manual = 39 (26%) Clerical = 12 (8%) Professional = 66 (44%) Missing = 19 (13%)	Unemployed = 5 (3%) Unskilled manual = 23 (15%) Skilled manual = 28 (18%) Clerical = 18 (12%) Professional = 64 (41%) Missing = 18 (12%)
Housing tenure up to age 12	Rented=38 (23%) Owned=116 (70%) Missing=11 (7%)	Rented=38 (25%) Owned=99 (66%) Missing=14 (9%)	Rented=40 (26%) Owned=101 (65%) Missing=15 (10%)
Moved house due to money problems up to age 12	Did not move=141 (85%) Moved=16 (10%) Missing=8 (5%)	Did not move=120 (79%) Moved=15 (10%) Missing=16 (11%)	Did not move=119 (76%) Moved=20 (13%) Missing=17 (11%)
Prefer a romantic partner with a high level of education	No=52 (32%) Yes=102 (62%) Missing=11 (7%)	No=45 (30%) Yes=97 (64%) Missing=9 (6%)	No=39 (25%) Yes=105 (67%) Missing=12 (8%)
Do you have any sisters?	No=79 (48%) Yes=82 (50%) Missing=4 (2%)	No=58 (38%) Yes=87 (58%) Missing=6 (4%)	No=66 (42%) Yes=85 (54%) Missing=5 (3%)
In general, do/es your sister/s do well at school?	No=17 (10%) Yes=64 (39%) Missing=84 (51%)	No=12 (8%) Yes=74 (49%) Missing=65 (43%)	No=10 (6%) Yes=72 (46%) Missing=74 (47%)
Do you have any brothers?	No=66 (40%) Yes=94 (57%) Missing=5 (3%)	No=63 (42%) Yes=82 (54%) Missing=6 (4%)	No=63 (40%) Yes=89 (57%) Missing=4 (3%)

CONDITION	MORTALITY SALIENCE	LONGEVITY SALIENCE	LOST PROPERTY CONTROL
In general, do/es your brother/s do well at school?	No=27 (16%) Yes=62 (38%) Missing=76 (46%)	No=25 (17%) Yes=55 (36%) Missing=71 (47%)	No=21 (13%) Yes=66 (42%) Missing=69 (44%)
With whom did you mostly live until age 12?	Both biological parents=112 (68%) Biological father only=3 (2%) Biological mother only=27 (16%) Biological father and stepmother=1 (1%) Stepfather and biological mother=5 (3%) Adopted father and biological mother=1 (1%) Two stepparents = 0 (0%) Stepfather only = 0 (0%) Two adopted parents=1 (1%) Grandparents=0 (0%) Other relatives=2 (1%) Foster parents=1 (1%) Institution=1 (1%) Missing=11 (7%)	Both biological parents=104 (69%) Biological father only=4 (3%) Biological mother only=19 (13%) Biological father and stepmother=0 (0%) Stepfather and biological mother=9 (6%) Adopted father and biological mother=1 (1%) Two stepparents = 0 (0%) Stepfather only = 0 (0%) Two adopted parents=0 (0%) Grandparents=2 (1%) Other relatives=1 (1%) Foster parents=1 (1%) Institution=0 (0%) Missing=10 (7%)	Both biological parents=110 (71%) Biological father only=2 (1%) Biological mother only=20 (13%) Biological father and stepmother=0 (0%) Stepfather and biological mother=4 (3%) Adopted father and biological mother=0 (0%) Two stepparents = 1 (1%) Stepfather only = 1 (1%) Two adopted parents=1 (1%) Grandparents=1 (1%) Other relatives=1 (1%) Foster parents=2 (1%) Institution=0 (0%) Missing=13 (8%)
Subjective childhood SES N=623	Mean= .06252169	Mean= -.0590453	Mean= -.0009984
Subjective current and future SES N=628	Mean= .02983875	Mean= -.05465525	Mean= -.01694101
Have you started to have sexual relationships?	No=37 (22%) Yes=116 (70%) Missing=12 (7%)	No=22 (15%) Yes=116 (77%) Missing=13 (9%)	No=30 (19%) Yes=113 (72%) Missing=13 (8%)
Age of sexual debut	Missing =46 (28%) Mean= 16.7	Missing =34 (23%) Mean= 16.9	Missing =46 (29%) Mean= 17.2

The majority said they did not have any religious beliefs (across conditions a mean of 68%). Educationally they were slightly more varied than has previously been the case with mortality salience research into pro-natalism, with the exception of Zhou et al. (2008) and Zhou et al. (2009). Unlike most previous studies which have used solely undergraduate students, the current sample had a mean across conditions of 39% who were currently students. Given their age, this could include pre-university education. However, a mean across conditions of 71% had at least AS-levels, A-levels, or an Access course qualification or higher, suggesting that most of them were either on the pathway to university or had already experienced it. No significant differences were found between the groups in any of the background measures, using chi-square and ANOVA tests (results not shown). This showed that random assignment had been successful.

3.3.2 Experimental analysis

Results for all dependent variables (including Subjective Life Expectancy) were analysed separately by sex. This was done using linear regression with the control condition (lost property) as the reference category, and the mortality and longevity salience group coded as dummy variables in order to test whether the mean of each group differed significantly from that of controls (Field, 2013). As all dependent variables had non-normal distribution of residuals (despite homogeneity of variance), standard errors were bootstrapped with 50 replications to make p-values more reliable (Wright, London, & Field, 2011).

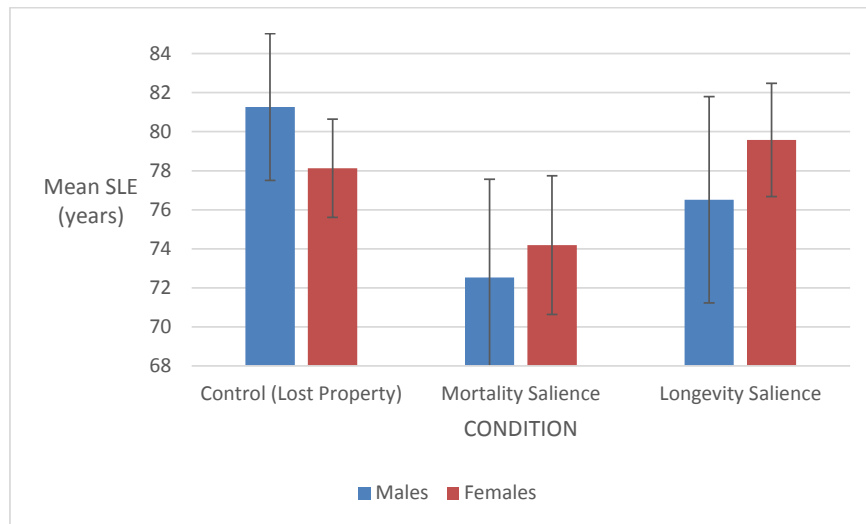
3.3.3 Subjective Life Expectancy (SLE)

First, we determined whether there was a treatment effect of condition (Mortality Salience and/or Longevity Salience) on Subjective Life Expectancy (SLE). Any effect on SLE might be expected to mediate any treatment effects on the dependent variables. This analysis also worked as a manipulation check, to ascertain that Mortality and/or Longevity Salience treatments had had the expected effects on participants in shortening or lengthening respectively participants' perceived longevity.

Mean SLE (in years) for males in the control condition was 81.27, in the Mortality Salience (MS) condition was 72.53, and in the Longevity Salience (LS) condition was 76.51. Comparing means showed that the MS condition had significantly shorter SLE than the control ($\beta = -8.739$, $z = -3.01$, $p = 0.003$). The LS condition did not differ significantly from the control condition ($\beta = -4.760$, $z = -1.75$, $p = 0.080$). Mean SLE for females was (in years) 78.13 for controls, 74.18 for MS, and 79.58 for LS. Neither mortality salience ($\beta = -3.944$, $z = -1.70$, $p = 0.089$) nor longevity salience ($\beta = 1.448$, $z = 0.94$, $p = 0.347$) gave an SLE that differed significantly from controls.

Results for both sexes can be seen in Figure 3.1.

Figure 3.1: Male Subjective Life Expectancy is significantly shorter in Mortality Salience condition than in Control condition; but there is no effect of Longevity Salience. No significant effects for females



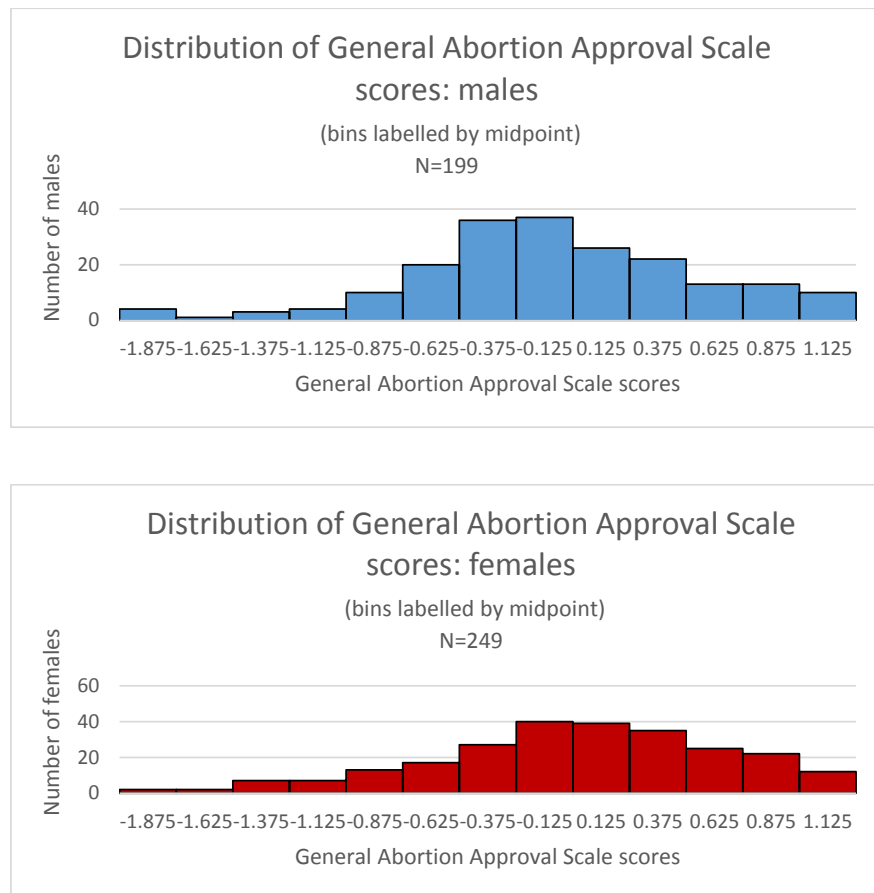
Therefore we can see that Mortality Salience meant significantly shorter SLE for males, but had no significant effect on female SLE, although the female trend was also towards shorter SLE. Longevity Salience had no significant effect on the SLE of either sex, but for females it was higher than in the control condition.

3.3.4 Abortion approval (general and personal)

Next, the effect of condition on Abortion Approval was investigated. Abortion Approval was measured overall by the General Abortion Approval Scale (answered by all participants and composed of ten hypothetical scenarios regarding the acceptability of a woman having an abortion) and then also with the personal abortion questions, where women were asked, ‘if you discovered you were pregnant now, would you have an abortion?’ Men were asked, ‘if you had a girlfriend who discovered now that she was pregnant by you, do you think

she should have an abortion?’ Scores were standardised so that overall neutrality regarding abortion approval would score zero. Compared to this, any score above zero would indicate a positive attitude to abortion and anything less than zero would mean relative disapproval of abortion. Figure 3.2 shows distributions for each sex on the general scale.

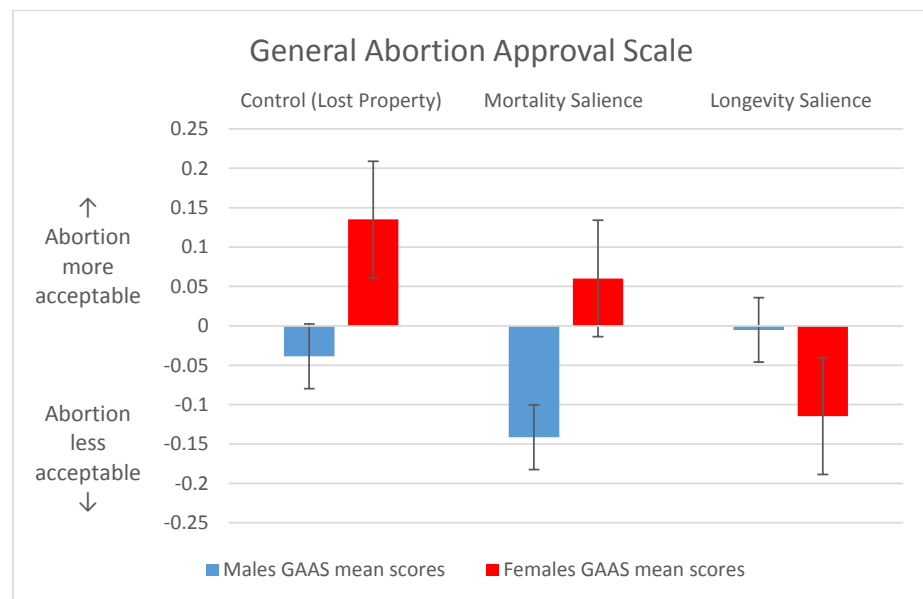
Figure 3.2: Distribution of scores on the General Abortion Approval Scale in males and females



Mean score on the GAAS for males was $-.038636$ for the control condition, $-.141$ for the MS condition, and $-.005$ for the LS condition. Although these scores were in the order predicted by hypotheses, neither the MS ($\beta = -.103, z = -0.95, p = 0.342$) nor the LS ($\beta = 0.034, z = 0.30, p = 0.761$) showed a difference from the control condition.

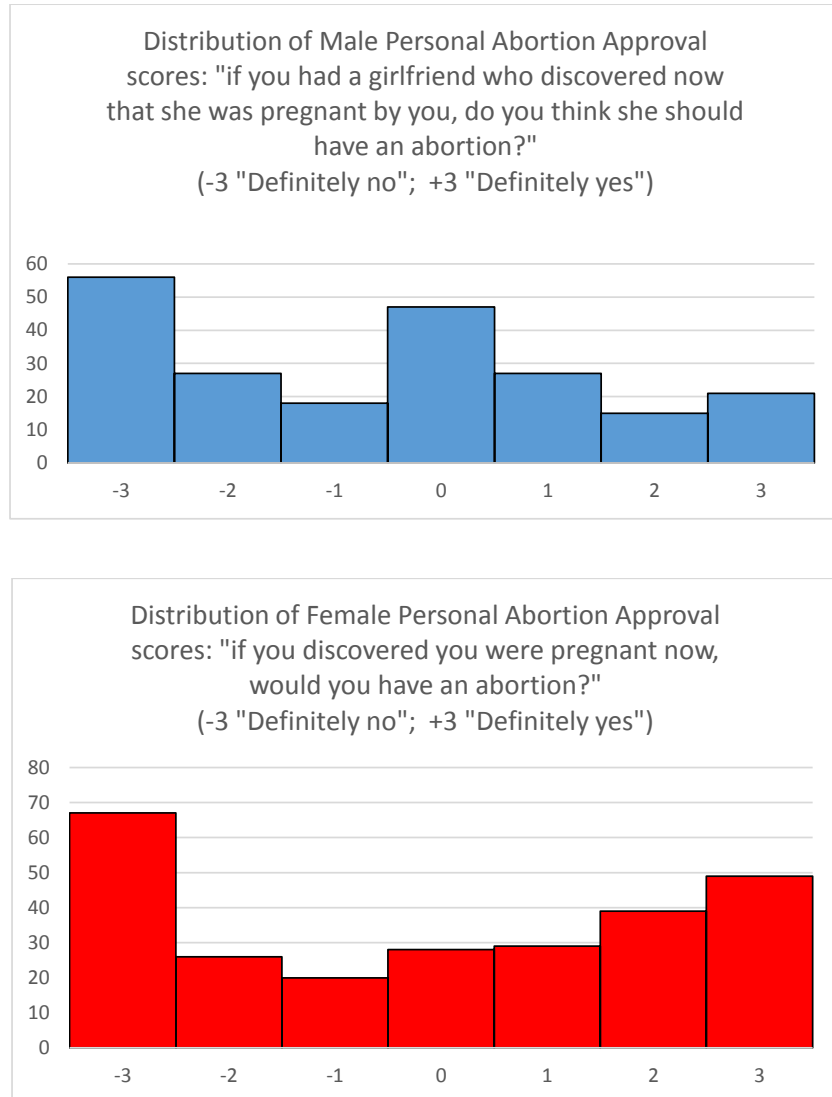
For females the mean score on the GAAS was .135 for the control condition, .060 for the MS condition, and -.115 for the LS condition. Women therefore were somewhat more approving of abortion than men, and the shift in attitudes between control and primed women was greater for women than men. The difference between the women in the Longevity Salience condition and the control condition was in the opposite direction to the hypothesis, however. The regression analysis showed that although MS did not give a significantly different GAAS score to controls ($\beta = -.075$, $z=-0.91$, $p=0.364$), LS meant that women were significantly less approving of abortion than controls ($\beta = -.250$, $z= -2.52$, $p=0.012$). These results can be seen in Figure 3.3.

Figure 3.3: Women in the Longevity Salience condition are significantly more disapproving of abortion than those in the control condition; while Mortality Salience has no effect. Males show no effect of experimental condition.



Next the results for the personal abortion approval scores for each sex were investigated. Figure 3.4 below shows the overall distributions for males and females.

Figure 3.4: Distribution of scores on the Personal Abortion Approval Scales in males and females



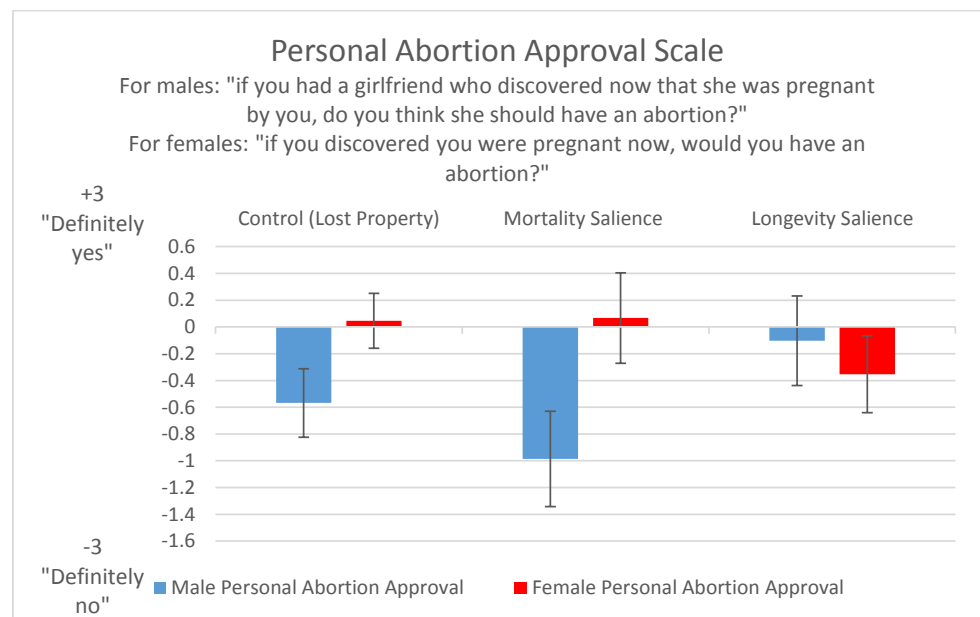
Effects of experimental condition were then analysed for each sex using ANOVA. Results for Male Personal Abortion Approval (MPAA) showed that the mean score for the control condition was $-.567$, for the MS condition was $-.987$, and for the LS condition was $-.103$. Neither the MS ($\beta = -.420, z=-1.20$,

p=0.231) nor the LS condition ($\beta = .464, z=1.42, p=0.157$) showed significant differences from the control condition, despite the trends being in the predicted directions.

Female Personal Abortion Approval (FPAA) showed a mean score for the control condition of .046, for MS of .067, and for LS of -.354. Neither of these results were in the predicted directions and neither MS ($\beta = .021, z=0.07, p=0.947$) nor LS ($\beta = -.400, z= -1.15, p=0.252$) were significantly different to controls. These results can be seen in Figure 3.5.

The results for Abortion Approval showed then only a significant effect of Longevity Salience on females, where scores on the GAAS were decreased compared to the control condition, indicating greater disapproval of abortion in that condition. There was no effect of treatment condition on either the Male or Female Personal Abortion Approval Scale.

Figure 3.5: No significant effects of treatment condition for either sex on the Personal Abortion Approval Scale



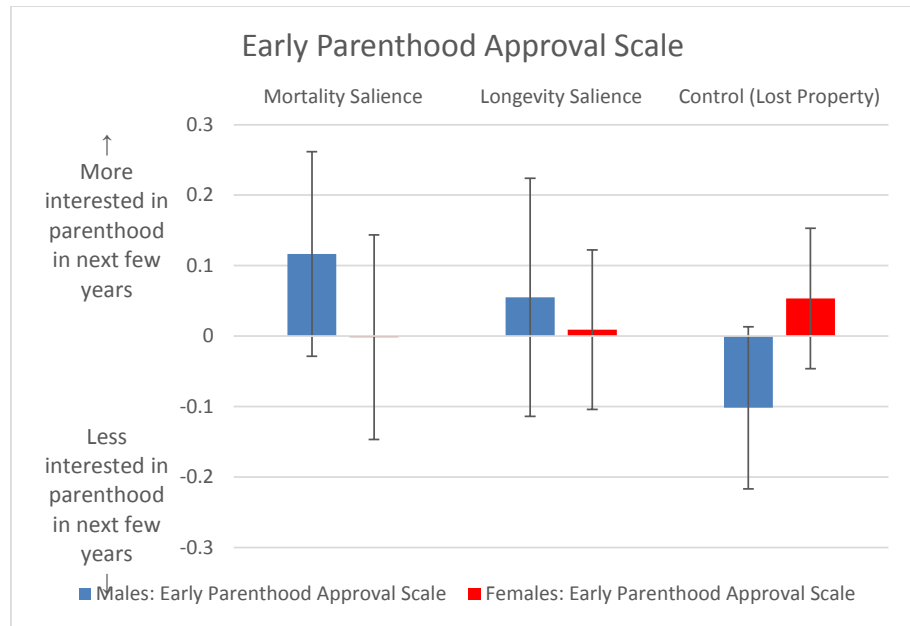
3.3.5 Early Parenthood Approval Scale

Next we analysed the results for the Early Parenthood Approval Scale, taken from Griskevicius et al. (2011) and described in Section 3.2.3.

For males, mean EPAS scores were -.102 for controls, .117 for MS, and .055 for LS. Although this meant that MS did elicit greater interest in early parenthood as predicted, LS did not elicit reduced interest in parenthood, contrary to hypotheses. Neither MS ($\beta = .218$, $z=2.02$, $p=0.150$) nor LS ($\beta = .157$, $z=1.14$, $p=0.199$) made a significant difference.

For females, EPAS score means were .053 for controls, -.002 for MS, and .009 for LS. This meant slightly reduced interest in parenthood under Mortality Salience, contrary to predictions; and a similar though smaller effect for Longevity Salience, the direction of which would be in line with predictions. However, the regression analysis showed that neither MS ($\beta = -.055$, $z= -0.39$, $p=0.735$) nor LS ($\beta = -.044$, $z= -0.31$, $p=0.768$) had a significant difference from controls. Therefore for this dependent variable there was no main effect of experimental condition for either sex. Results for this dependent variable are seen in the graph in Figure 5.

Figure 3.6: No significant effects of treatment condition for either sex on Early Parenthood Approval Scale



3.3.6 Support for hypotheses

In terms of the hypotheses, here is how the results measured up, shown in Tables 3.2, 3.3 and 3.4.

Table 3.2: How far did results for General Abortion Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Mortality Salience: Abortion Approval is expected to be significantly lower than the control in this condition.	No. Although mean GAAS score in this condition was lower than for controls as predicted, this difference was not significant.	No. Mean GAAS score in this condition was lower than for controls as predicted, but this difference was not significant.
Longevity Salience: Abortion Approval is expected to be higher than for controls in this condition.	No. Although mean GAAS scores under LS were higher than for controls as predicted, this difference was not significant.	No. Mean GAAS scores in the LS condition were actually lower than for controls, contrary to the hypothesis.
Actual order of results across MS, LS and control.	HIGHEST ABORTION APPROVAL: Longevity Salience MIDDLE ABORTION APPROVAL: Controls LOWEST ABORTION APPROVAL: Mortality Salience	HIGHEST ABORTION APPROVAL: Controls MIDDLE ABORTION APPROVAL: Mortality Salience LOWEST ABORTION APPROVAL: Longevity Salience

Table 3.3: How far did results for Personal Abortion Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Mortality Salienc: Abortion Approval is expected to be significantly lower than the control in this condition.	No. Although male Personal Abortion Approval was lower than for controls as predicted, this difference was not significant.	No. For females in the MS condition, Personal Abortion Approval was slightly higher than for controls, contrary to predictions.
Longevity Salienc: Abortion Approval is expected to be higher than for controls in this condition.	No. Although male Personal Abortion Approval was higher than for controls, this difference was not significant.	No. For females in the LS condition, Personal Abortion Approval was lower than for controls (though not significantly). This effect is in a direction contrary to predictions.
Actual order of results across MS, LS and control.	HIGHEST ABORTION APPROVAL: Longevity Salienc MIDDLE ABORTION APPROVAL: Controls LOWEST ABORTION APPROVAL: Mortality Salienc	HIGHEST ABORTION APPROVAL: Mortality Salienc MIDDLE ABORTION APPROVAL: Controls LOWEST ABORTION APPROVAL: Longevity Salienc

Table 3.4: How far did results for Early Parenthood Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Mortality Salience: Early Parenthood Approval is expected to be significantly higher in this condition than for controls.	No. Although Early Parenthood Approval was higher in the MS condition than for controls, this was not a statistically significant difference.	No. In the MS condition, Early Parenthood Approval was actually lower than for controls (though not significantly). This ran counter to predictions.
Longevity Salience: Early Parenthood Approval is expected to be significantly lower in this condition than for controls.	No. Early Parenthood Approval was higher for males in the LS condition (though not significantly). This was counter to predictions.	No. Early Parenthood Approval was lower in the LS condition than for controls as predicted, though not significantly so.
Actual order of results across MS, LS and control.	HIGHEST EARLY PARENTHOOD APPROVAL: Mortality Salience MIDDLE EARLY PARENTHOOD APPROVAL: Longevity Salience LOWEST EARLY PARENTHOOD APPROVAL: Controls	HIGHEST EARLY PARENTHOOD APPROVAL: Controls MIDDLE EARLY PARENTHOOD APPROVAL: Longevity Salience LOWEST EARLY PARENTHOOD APPROVAL: Mortality Salience

Therefore none of the hypothesis were supported. However, for males on the General Abortion Approval Scale and the Male Personal Abortion Approval Scale, trends were in the directions predicted i.e. that Mortality Salience meant more pro-natal responses and Longevity Salience elicited more anti-natal responses, although not statistically significant. Additionally, for males in the Mortality Salience condition, their scores were in the direction predicted for the Early Parenthood Approval Scale, though not statistically significant. However, male scores under Longevity Salience for the same dependent variable were neither significant nor in the direction predicted. For females, only twice did responses even run in the same direction as predictions: under Mortality Salience their mean General Abortion Approval Scale scores were lower than for controls; and under Longevity Salience Early Parenthood Approval was lower than for controls. The rest of the time, female responses

ran counter to predictions, in one case being statistically significant: that under Longevity Salience, females are significantly less approving of abortion than controls as measured by the General Abortion Approval Scale.

Table 3.5 summarises these trends in terms of pro-natalism and statistical significance. The results are symbolised by pro-natal (+) and anti-natal (-) effects. Pro-natal is where there is an increased desire to have children (e.g. by becoming more anti-abortion) or to have them sooner. Anti-natalism is the opposite. To summarise broadly, male responses usually trended in the predicted directions i.e. becoming more pro-natal under Mortality Salience and more anti-natal under Longevity Salience. The exception to this is with the Early Parenthood Approval Scale under Longevity Salience, where being prompted to think about living a long time in a healthy state elicited more pro-natal responses than expected. Women's responses were further away from predictions. The only statistically significant response was that they became more pro-natal under Longevity Salience when asked to answer questions about the acceptability of abortion under ten hypothetical scenarios. They felt similarly in the same condition, though to a non-significant degree, when asked whether they would have an abortion now if they were pregnant. However, when asked to think about their interest in becoming a parent soon scored on the EPAS, this elicited an anti-natal response, just as it did under Mortality Salience. In fact Mortality Salience only drove female responses towards pro-natalism when they were asked about a third party in the GAAS, not when they were asked about whether they would have an abortion themselves if they were pregnant now.

Table 3.5: Summary of Direction and Significance Level in terms of Pro-Natalism of main Experimental Effects for Males and Females Compared to Controls

	MORTALITY SALIENCE			LONGEVITY SALIENCE		
	General Abortion Approval Scale	Personal Abortion Approval Scale	Early Parenthood Approval Scale	General Abortion Approval Scale	Personal Abortion Approval Scale	Early Parenthood Approval Scale
MALES						
Pro-natal (+) or anti-natal? Significant (p-value) or non-significant (NS)?	+ NS	+ NS	+ NS	- NS	- NS	+ NS
Strength of effect compared to other treatment if in same direction			Stronger pro-natal effect than under Longevity Salience			Weaker pro-natal effect than under Mortality Salience
FEMALES						
Pro-natal (+) or anti-natal? Significant (p-value) or non-significant (NS)?	+ NS	- NS	- NS	+ p=0.012	+ NS	- NS
Strength of effect compared to other treatment if in same direction			Stronger anti-natal effect than under Longevity Salience			Weaker anti-natal effect than under Mortality Salience

3.3.7 Interactions between condition and socioeconomic status (SES) on each dependent variable

Next, we tested whether there were any interactions between experimental condition and different types of socioeconomic status (childhood/current; subjective/objective), following previous research (Griskevicius et al., 2011) and looking at effects on all our dependent variables: SLE, GAAS, MPAA, FPAA and EPAS. Although these previous authors found significant interaction between

Mortality Salience and Subjective Childhood Socioeconomic Status in their effects on the Early Parenthood Approval Scale, this is not predicted or investigated within the wider Mortality Salience literature, including that influenced by Life History Theory (Mathews & Sear, 2008). There was no predicted direction for these interactions and they were thus exploratory.

The four socioeconomic status variables for which potential interactions were explored were the following:

- 1) Subjective Childhood SES
- 2) Subjective Current/Future SES

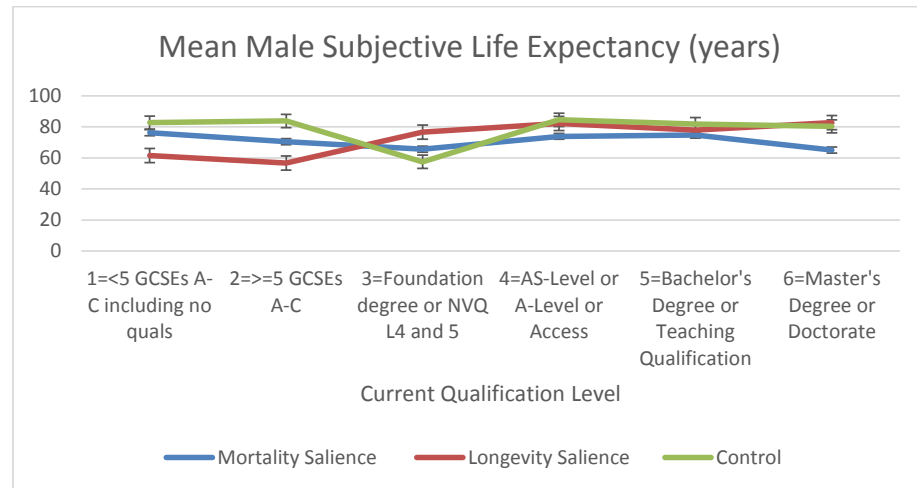
Both of the above measures were taken from previous research by Griskevicius et al. (2011). Following data collection, a Principal Components Analysis was done of their six items (described earlier in Method). There were two components with eigenvalues over 1 (2.90 and 1.30). These were extracted and rotated using the oblimin method to attain simple structure and allow correlation. Rotated Component One loaded on the childhood SES items with item loadings ranging from .56 to .58 and accounted for 36% of item variance; and Rotated Component Two loaded on the current/future SES items with item loadings ranging from .57 to .59 and accounted for 34% of item variance. The components were moderately correlated ($r = .38$). Composites were created from each, with the Cronbach's alpha for Subjective Childhood SES being .79 and that for Subjective Current/Future SES being .76. Each measure was standardised with a mean of 0 and a standard deviation of 1.

- 3) Objective Childhood SES: this was measured by the highest-paid job status of the participant's highest-earning parent during childhood, and came in 5 categories: 1=unemployed; 2= unskilled manual; 3= skilled manual; 4= Clerical/Administrative; 5= Professional/Managerial.

- 4) Objective Current Socioeconomic Status: following data exploration, it was decided to use Current Qualifications as a measure of current objective socioeconomic status. This is because among the 18-25-year-old participants it was less correlated with age than was current job status ($r = .1202$ compared with $r = .4629$). The Current Qualifications variable was then recoded to six categories due to low frequencies in the lowest and highest qualification categories. The lowest category, 1, now means up to 5 GCSEs A-C including no qualifications; the highest category, 6, means Masters or Doctorate. The other categories were 2: 5 or more GCSEs A-C; 3: National Vocational Qualification (NVQ) Level 4 or 5; 4: AS-Level, A-Level or Access course; 5: Bachelor's degree or teaching qualification.

Investigating interactions between each treatment condition and the different types of socioeconomic status in terms of effects on Subjective Life Expectancy found only one significant interaction: that in the longevity salience condition, males with a higher qualification level had higher SLE compared to controls ($\beta = 4.434$, $z = 2.16$, $p = 0.031$). However, on further investigation of the interaction (see Figure 3.7), it seems to have been mostly caused by the fact that in the control condition there were only two male participants at qualification level 3, whereas in the LS condition there were six male participants. This helped their SLE means to diverge at this point, but nowhere else.

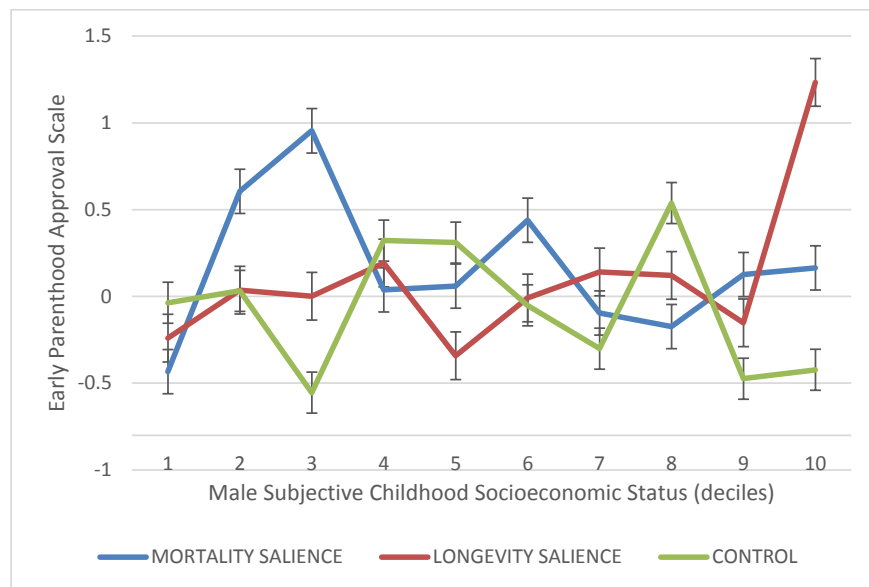
Figure 3.7: In the Longevity Salience condition, males with a higher objective current socioeconomic status (measured with current qualifications) had a higher subjective life expectancy.



Next interactions between the four different types of socioeconomic status and the treatment conditions were explored for any effect on the General Abortion Approval Scale. Socioeconomic status did not interact significantly with any of the treatment conditions. There were also no significant interactions with socioeconomic status in terms of effects on Male or Female Personal Abortion Approval Scale. In terms of interactions between treatment and socioeconomic status affecting Early Parenthood Approval Scale, there was one significant interaction: for males in the Longevity Salience condition, as subjective childhood SES increased, scores on the Early Parenthood Approval Scale increased compared to controls ($\beta = .413$, $z = 2.56$, $p = 0.027$). These results were explored using a graph, seen in Figure 3.8. Due to low frequencies at individual values, the results are graphed in deciles, where we see that the interaction only definitively occurs between the ninth and tenth deciles of subjective childhood SES, where there is a large difference between the

Longevity Salience and Control conditions in terms of approval of early parenthood. However, in the tenth decile there are only five participants in the LS condition (with seven in the control condition), and therefore we remain cautious about claiming this as a genuine interaction. It might have simply occurred by chance due to multiple testing.

Figure 3.8: Males in the Longevity Salience condition are more likely than controls to approve of Early Parenthood at the highest levels of subjective childhood socioeconomic status.



3.4 Discussion

3.4.1 Main results

In summary, the results of testing the main effect of the experimental condition on the dependent variables were:

- 1) General Abortion Approval Scale: For women, the Longevity Salience condition meant significantly lower abortion approval on this scale compared to controls. Mortality Salience did not affect female GAAS responses. Men saw no effect of either treatment condition on this scale.
- 2) Male/ Female Personal Abortion Approval Scales: There were no effects of treatment condition for either sex.

- 3) Early Parenthood Approval Scale: there were no effects of treatment condition for either sex.

3.4.2 General trends in results

Thinking about the overall pattern of results, including non-significant results as seen in Table 3.5, the following trends are seen. For men, Mortality Salience was associated with increased pro-natalism; Longevity Salience meant decreased pro-natalism in the form of increased abortion approval. These trends are in line with hypotheses in terms of their direction. However, Longevity Salience for males also meant increased pro-natalism measured by the Early Parenthood Approval Scale, contrary to predictions. For women, Mortality Salience meant increased pro-natalism when referring to a third party in the form of a hypothetical woman, but otherwise decreased pro-natalism when thinking of their own behaviour. Longevity Salience seems to have increased female pro-natalism when measured with abortion approval (in one case significantly), but decreased it when considering imminent parenthood. If these are genuine effects (albeit underpowered), then it seems that men are mostly behaving as life history theory would predict, but equally, in the case of lower abortion approval for men under Mortality Salience, it could be that, as seen in some Terror Management Theory experiments (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989), individuals are cleaving more strongly to social norms when reminded of death, especially given that men are slightly more disapproving of abortion than women overall. Women, conversely, seem to be more anti-natal under Mortality Salience (unless they are thinking of a third party), contrary to hypotheses; and under Longevity Salience they also behave against predictions, apart from when they are thinking of becoming a parent soon, not abortion. Longevity Salience appears to have reverse effects

for the two sexes. Men and women probably experience the idea of longevity differently from each other, with different psychological associations. For women in developed societies nowadays longevity is simply more likely than for men (Case & Paxson, 2005; Kruger & Nesse, 2006). Women As the majority of these effects were not statistically significant it is impossible to say whether or not the patterns indicate the ghost of genuine effects.

3.4.3 Subjective Life Expectancy

Although men did have significantly shorter Subjective Life Expectancy under Mortality Salience, this did not then play out with reference to significant effects in the same condition for any of the reproduction-related variables. For men Longevity Salience also elicited a (non-significantly) shorter SLE than for controls, suggesting that this cue was not operating as we expected. As the Longevity Salience prime actually (non-significantly) elicited a shorter Subjective Life Expectancy from the men, it might be that asking these 18-25-year old males to consider healthy old age is actually tantamount to making them think about death, as it might be rare for them to mix with older people in real life. Furthermore, although women displayed the only truly measurable behavioural effect, becoming more anti-abortion under Longevity Salience when thinking of a hypothetical female (measured with the GAAS), female SLE was not affected by the same treatment condition, although it did increase as one would expect, but not significantly so. This means two possibilities: SLE and reproductive motivation are not linked, contrary to theoretical assumptions; or our measures are not adequately tapping into these feelings, which are unlikely to be completely consciously perceptible. In particular, self-reporting SLE, especially under experimental conditions, may produce some artificial or even jokey

responses. If SLE and reproductive motivation are not linked, then the means by which women's GAAS score decreased under Longevity Salience must be via another mechanism, though it is difficult to know what. Using an instrument such as the PANAS (Positive and Negative Affect Scale) (E. R. Thompson, 2007) to measure the emotional effect of the stimulus immediately after it is presented might be useful, and indeed this is done in the next experiment investigating the effects of Morbidity and Mortality Salience, described in Chapter Four.

For females the mortality and longevity primes did actually send SLE in the expected directions, though not to any statistically significant extent. It may be that the primes were simply not strong enough, and certainly during their design there was the need to adhere to ethical standards for online research in terms of avoiding causing unnecessary distress e.g. in making people think about death. To deal with such ethical issues those who had been recently bereaved were also screened out of participation, and it remains to be seen whether they would have responded differently to the mortality or longevity primes.

3.4.4 Other possible reasons for the significant result

Notwithstanding the fact that Subjective Life Expectancy appeared not to mediate female GAAS scores in the Longevity Salience condition, speculation on how the LS stimulus might have had the effect it did is possible. Perhaps the women in this condition were reminded of positive things like good physical/mental health (e.g. in the question on what might increase life expectancy; people becoming healthier and fitter); and negative things like the possibility of regretting not becoming a parent (e.g. the questions on activities during retirement; the question on whether they had ever become friends with a much older person). The questions might also have made them think of family,

ancestry and relationships. Such putative feelings may make people less inclined to approve of abortion, perhaps by making them more reflective about what lies ahead. It is possible that for women, thinking about a long, healthy life induces positive emotions of safety and wellbeing which stimulate reproductive motivation: indeed, Silvers and Haidt (2008) discovered that nursing women actually lactated more while viewing a morally elevating video as opposed to a comedy video. This could be a situation where lower future discounting actually makes women more inclined towards reproduction, an opposite way of thinking to that proposed by the conceptualisation of Life History Theory in this experiment, where considering an extended future might be expected to decrease current pro-natalism. Perhaps the Longevity Salience cues in the current experiment were on some level interpreted by the women as indicating that the world is currently a safe place full of relationships, good health, and elderly relatives. If this is the case, why terminate a pregnancy? Why not continue it? In real life, because they are just 18-25 years old, most of them fairly well educated, and from a developed nation where the mean age at first birth was 28.3 in 2013 (ONS, 2014), they are likely to wait until they are in a 'better' situation before they reproduce i.e. one with more money (achieved via education and/or a partner) and where they have achieved some of their personal, professional or recreational ambitions. But it could be that the Longevity Salience cues made them think of the fundamentals of life such as health and relationships, momentarily acquire a broader perspective, and become momentarily more anti-abortion. However, this pro-natal shift might not be unified and coherent, as under the same LS cue their Early Parenthood Approval Scale scores (non-significantly) decreased.

This discrepancy between the different measures regarding pro-natalism might hint that measuring reproductive motivation will be affected by the means by which it is tracked. Indeed, looking back at Table 3.5, it is not unusual for the pro- or anti-natal trend measured by Early Parenthood Approval Scale to go in a different direction to that measured by the Abortion Approval Scales. Even though the LS condition decreased female scores on the GAAS, it did not do the same to a statistically significant degree on the Female Personal Abortion Approval Scale. Therefore Longevity Salience only elicited these pro-natal feelings when women were thinking about someone else and whether it was 'acceptable' for her to have an abortion.

3.4.5 Non-significant findings for other outcomes

It is also possible that Personal Abortion Approval and Early Parenthood Approval were too pertinent to our young female participants' lives to be affected by external stimuli. Although abortion can be framed as an abstract moral question, it is often an extremely emotional and directly pragmatic question for people who are facing such a dilemma. Approval or disapproval of abortion in the abstract as a moral stance might have little to do with one's desire to have children in the near future. It is possible that abortion in the abstract as opposed to abortion as it relates to one's personal situation are two different things: Lee et al. (2004) found that the young women who had been very anti-abortion prior to having their first child developed more pragmatic attitudes to it after becoming mothers. This coincides with the social intuitionist view of moral psychology (Jonathan Haidt, 2001), wherein moral judgements are post-hoc rationalisations of emotional reactions, are responses to social and cultural influences, and may be eminently changeable (Hall, Johansson, &

Strandberg, 2012). It is unsurprising that such discrepancies exist, as we are all capable of inconsistency, self-deception and hypocrisy, particularly on 'moral' issues (Gazzaniga, 1998; Kurzban, 2012; Von Hippel & Trivers, 2011) as it is adaptive to pursue our self-interest, which demands great flexibility and responsiveness to situational demands.

3.4.6 Sex differences

Male participants saw no significant effect of condition on any of the reproduction-related dependent variables, a result which is in the main no different from the female results. Males of this 18-25-year-old age group in a developed world setting might be unlikely to think of reproduction-related matters much at all, unless forced to. Therefore reproductive motivation itself might be far less cognitively salient for them than for women, which might explain the non-significant trends in responses discussed earlier, as they could indicate something occurring below a measurable threshold.

The fact that only female scores on the General Abortion Approval Scale appeared to be manipulable might be an echo of Mathews and Sear (2008)'s findings that their only significant result of Mortality Salience was in increasing males' 'ideal' number of children. Perhaps invoking concepts such as 'ideal' or asking what a third party should do (on the GAAS) are enough to make individuals more opinionated and less considered.

Early Parenthood Approval Scale was found in previous research by Griskevicius et al. (2011) to be affected by Mortality Salience, albeit in interaction with subjective childhood socioeconomic status. Early Parenthood Approval is perhaps a more 'pure' measure of imminent reproductive intent

than either of the Abortion Approval variables. It is the interactions in the current research which we will discuss next.

In investigating the interactions between experimental condition and various types of socioeconomic status (subjective or objective; childhood or current/future), these were the only significant results:

- 1) Subjective Life Expectancy: for males in the Longevity Salience condition compared to control, as current objective SES (measured by current qualifications) increased, so did SLE.
- 2) Early Parenthood Approval Scale: here, males in the Longevity Salience condition compared to control showed higher approval for early parenthood in the top decile of subjective childhood SES.

Males primed to think of longevity had longer Subjective Life Expectancy the higher their current qualification level. This is notable, considering that males in general did not see a significant effect of Longevity Salience and the general trend for males in this condition was towards shorter SLE. This result does not relate to the main aims of this paper, so discussion of it will not be extended. It might suffice to say that in the real world although males in this age group experience a sharp rise in mortality rates, it is attenuated for those with higher education and this may be because for these individuals resources are more predictable and life is less harsh, and therefore risky strategies likely to result in early death are less likely (Kruger & Nesse, 2006). This does not explain, however, why the Mortality Salience condition did not see a parallel interaction with socioeconomic status, especially as it was only Mortality Salience which had a main effect on SLE.

The only other significant interaction with socioeconomic status was that males in the Longevity Salience condition showed higher approval for early

parenthood at very high levels of subjective childhood socioeconomic status. They were in the top decile for socioeconomic status; and above the 90th percentile for their scores on Early Parenthood Approval scale. This finding is conceptually in the opposite direction to that of Griskevicius et al. (2011), who found that primed by Mortality Salience, individuals of both sexes approved more of early parenthood if they had low subjective childhood socioeconomic status; whereas those who said they had grown up relatively wealthy showed reduced interest in early parenthood. The measure used to ascertain Early Parenthood Approval here is identical to that used by Griskevicius et al., whose results were attributed to mortality cues shifting people into different life history strategies calibrated by early resource availability. In the current experiment, not only was there a sex difference, but also according to the logic of the previous findings, those primed to think they would live a long time should be expected to approve of early parenthood less, as according to Life History Theory they would have a slower reproductive strategy, particularly the higher their subjective childhood socioeconomic status. These results could be similar to the main effects of Longevity Salience on female General Abortion Approval: perhaps being reminded of a long, healthy life for these men who recalled an extremely well off childhood compared to other participants was enough to make them feel that parenthood would be easy to cope with imminently.

In terms of Life History Theory, then, there is no simple explanation for the results. It could perhaps be argued that humans have only evolved to respond to cues of short life expectancy rather than long life expectancy, but this would not explain why one of the main effects and both of the interactions occurred

specifically in the Longevity Salience condition. As the other interaction with socioeconomic status indicated that Subjective Life Expectancy was higher for males primed with longevity who also had relatively more education compared to the rest of the sample, it could be that these are the same individuals who have relatively high subjective childhood socioeconomic status and who therefore see early parenthood as practically viable due to past and current resource access. However, the correlation among males generally between Current Objective Socioeconomic Status (measured by current qualifications) and Subjective Childhood Socioeconomic Status is quite low ($r = .23$); and in those who were primed with Longevity Salience even lower ($r = .18$), so this cannot be the explanation. It is also known that during the period of data collection for this experiment, the current cohort of 18-25-year-olds resident in England and Wales have experienced high unemployment compared to their predecessors and so even with a high level of academic qualifications have not experienced guaranteed resource access (ONS). Indeed among males in the Longevity Salience condition the correlation between current qualification level and socioeconomic status measured by current job status is only $r = .1285$ and in the whole sample only $r = .1505$.

The measure of subjective current/future SES did not interact significantly with treatment condition in any way. As argued by Griskevicius et al. (2011), it could be that it is specifically during childhood that life history theory is calibrated, making it more salient to a person than current/future subjective SES. The measure of objective childhood SES also had no interaction effect, and this might be because it is difficult to get information on the job level someone's parent had years ago, due to recall problems. Current objective SES measured by

current qualifications did contribute to Subjective Life Expectancy, but not to reproductive preferences. It is important to be clear that because so many interactions with socioeconomic status were tested, the significant results could have occurred merely by chance, especially as we had no clear predictions on this matter.

3.4.7 Innovations in this experiment

In this experiment there were various methodological advances: a novel dependent variable (abortion approval measured in both an abstract and a personal way); Longevity Salience used as conceptual opposite to Mortality Salience; Subjective Life Expectancy measured as a potential mediator of treatment effects and as a manipulation check. Additionally, the 18-25-year-old sample was not solely composed of undergraduates and so might be expected to exhibit a broader range of life history strategies if, as argued by some, socioeconomic status broadly maps onto evolved reproductive strategy. It was particularly useful to see the dissociation between the effect of treatment condition on SLE and its effect on female General Abortion Approval. Thus we are able to say that SLE is probably not mediating treatment effects on fertility-related attitudes.

3.4.8 Limitations to the research

Nonetheless, there were limitations to the work. The control condition took the form of a bogus quiz about Lost Property with exactly the same format as the Mortality and Longevity Salience conditions. Previous Life History Theory researchers finding effects of mortality salience had used the bogus quiz as a stimulus (Mathews & Sear, 2008), albeit with a no-stimulus control; and the content (lost property) was thematically similar to the 'lost keys' control used

by Griskevicius et al. (2011). The current control condition was a synthesis of the two, but it is not certain what effect it had on participants and whether that effect was neutral in its effects. Certainly in the control condition there was higher male Subjective Life Expectancy than in the Longevity Salience condition, an unexpected result although not a significant difference. Equally in terms of the reproduction-related dependent variables, the highest female General Abortion Approval was in the control condition (though not significantly different to the Mortality Salience condition), and it is hard to know what to make of these trends. Future research could perhaps refrain from using both a Longevity Salience and a Mortality Salience stimulus simultaneously, since this conceptually requires that the control condition produce scores 'in between' the two, which is challenging for the researcher.

It is also interesting to see that the Mortality Salience prime had no effect on either SLE or on the reproduction-related dependent variables. This could either be a failure to replicate previous Mortality Salience research; an indication that abortion approval/disapproval is not the same as more conventional indicators of fertility preferences; or it could be that the prime were not strong enough. Certainly in order to receive ethical approval for their use within an online study (where there is no researcher available to attend to any participant distress) much attention was paid to keeping the primes 'safe' for participants, as well as screening out the recently bereaved; and this could have muted their effects.

In real life, actual abortion decisions are probably made via 'higher-order' deliberative cognitive processes Nettle (2010b) than in response to simple contextual evocation which is mimicked here. Even if abortion attitudes could

be reliably manipulated experimentally, it does not follow that this process would have much in common with what occurs in reality. When a woman does choose abortion or motherhood in a context where the opposite decision is the local social norm, it could be that in response to expectations of social stigma, she engages in private argumentation about the reasons behind her decision, as described by Mercier and Sperber (2011). It is known from the previous research that stated fertility preferences can be manipulated in certain circumstances: we also cannot assume that these preferences make their way unaltered into actualised fertility as there are many intervening factors.

3.4.9 Conclusion

Overall, then, the current research tentatively suggests that making the young females in this sample think about longevity makes them less approving of abortion when it is measured in an abstract and impersonal way. This is contrary to the predictions of Life History Theory, and indeed does not appear to have occurred via manipulation of their Subjective Life Expectancy. Male Subjective Life Expectancy did become shorter in a Mortality Salience condition, but there was no concomitant shift in reproductive preferences, including not only abortion approval, but also Early Parenthood Approval, which in previous research increased among those brought up poor when exposed to Mortality Salience. Interactions between treatment and socioeconomic status were slight: the more highly educated males did experience longer SLE in the Longevity Salience condition but this did not play out in any reproductive preferences; those few males who had experienced the very highest subjective childhood SES appeared to want to have children sooner than others when made to think of longevity, but this did not affect their SLE. From these results it appears that

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Student	SANDRA VIRGO
Principal Supervisor	DR. REBECCA SEAR
Thesis Title	Are risk of mortality and morbidity determinants of abortion behaviour and attitudes in England & Wales?

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?	
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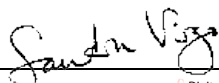
SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	DEMOGRAPHIC RESEARCH
Please list the paper's authors in the intended authorship order:	SANDRA VIRGO, REBECCA SEAR
Stage of publication	PRE-SUBMISSION

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Sandra Virgo was responsible for designing this study, conducting it, analysing data and writing up results. Rebecca Sear supervised the study and contributed to writing up the paper.
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Student Signature: _____



Date: 28/09/2015

Supervisor Signature: _____

Rebecca Sear

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Date: 2015.09.28 21:24:21 +01'00'

Date: 28/09/2015

time horizons might not be an important factor for younger people when considering fertility preferences.

Thus the current research fails to replicate previous Mortality Salience findings from Life History Theory with regard to fertility preferences, as well as further predictions which can be conceptually derived from them e.g. the role of Longevity Salience; the use of abortion approval as a fertility-related dependent variable. Further research should be done to investigate how far abortion approval can be manipulated in the same way as other stated fertility preferences.

Chapter 4 Does Morbidity Salience promote anti-abortion attitudes?

Psychological experiments show that under conditions where thoughts of death are made salient, people express increased desire to have children; desire for more offspring; and greater disapproval of birth control measures. This echoes behavioural ecological research showing that organisms respond to a high-mortality environment by adopting a 'fast' life-history strategy. We test the prediction that mortality salience influences attitudes towards abortion such that people become less approving of abortion (i.e. more pro-natal), replicating a previous experiment by the authors. We also test the hypothesis that reminders of morbidity (chronic illness), arguably more important in populations who have experienced the epidemiological transition, will also make people less approving of abortion than controls. We used an online sample of unmarried, childless 18-25-year-olds from England and Wales. Abortion approval was measured both generally (judging the actions of a hypothetical woman) and personally (asking participants if they/their partner would be likely to have an abortion if pregnant now). Results showed little support for the hypotheses. Overall, mortality and morbidity priming had little effect on abortion attitudes, compared to the control group who received a neutral prime. The only statistically significant result ($p=0.029$) was that mortality priming made females significantly more approving of abortion than controls when they were asked if they would have an abortion if they were pregnant now: a result counter to the hypothesis. Non-significant trends in the

results for women found under Morbidity Salience decreased general abortion approval and increased personal abortion approval compared to controls; and under Mortality Salience a general anti-natal swing. Both conditions made women give a slightly younger Ideal Age to Start Having Children, however. For men the trends were towards lower abortion approval compared to controls under Morbidity Salience; and under Mortality Salience decreased abortion approval on the general measure, with increased abortion approval on the personal measure. Compared to previous published mortality salience research showing increased pro-natalism, abortion attitudes measured using personal questions tend to move in an opposite, anti-natal, direction; but more general measures of abortion attitudes show more pro-natal responses than controls, showing a possible dissociation between personal pragmatism and general moral stances.

4.1 Introduction

Psychological experiments have shown that when thoughts of death are made salient, participants indicate that they would prefer to have children earlier; to have more children; greater preference for children; and greater disapproval of birth control policies compared to controls (Fritsche et al., 2007; Griskevicius et al., 2011; Mathews & Sear, 2008; Taubman–Ben-Ari & Katz–Ben-Ami, 2008; Wisman & Goldenberg, 2005; Yaakobi et al., 2014; Zhou et al., 2009; Zhou et al., 2008). Some of this work has been done by evolutionary life history theorists who are interested in the similarity of these results to observational research both in humans and non-humans which shows that high mortality is correlated with relatively early maturation and reproduction (a ‘fast’ life history strategy); while a ‘slow’ strategy is seen in less risky environments (Charnov, 1991; B S Low et al., 2008; Walker et al., 2006). Not only can this occur in the form of adaptations (Migliano et al., 2007), but current ecological cues may influence an individual via physiological and psychological pathways (Del Giudice & Belsky,

2011; Nettle, 2010a; Nettle, 2011), which therefore may offer theoretical impetus to the mortality salience experimental results.

4.1.1 Previous research by the current author

In an extension of those experiments, the current researchers investigated whether mortality salience makes people more disapproving of abortion in a group of 18-25-year-olds from England and Wales. Abortion is legally available in the UK, and according to 2013 data in England and Wales the age-standardised abortion rate was 15.9 per 1,000 resident women aged 15-44, a total of 190,800 terminations having been undertaken. In these 2013 data the highest rate was seen among those aged 20-24, an abortion rate of 28.5 per 1000 women (Nakatudde, 2014), showing that it is a widely used method of managing fertility. Induced abortion is a proximate determinant of fertility (Bongaarts, 1978) and appears to be used by younger women as a means of delaying first reproduction, especially in places where there are career and educational opportunities (Lee et al., 2004), and also (linking back to life history theory) where there is longer life expectancy. Our previous experiment, described in Chapter Three, found that there was no significant effect of mortality salience in terms of its effect on abortion attitudes or other fertility-related preferences; however its conceptual opposite, longevity salience, meant lowered abortion approval in females compared to controls, which was contrary to the hypothesis. Here we replicate and extend our previous study. Replications are important in scientific research, as there exists often a publication bias towards significant results, giving an exaggerated impression of the reliability of an effect. This problem has been found to be widespread in psychological science (Kühberger, Fritz, & Scherndl, 2014).

A crucial development in the new experiment is the addition of morbidity priming as a treatment condition, to determine whether, as hypothesised, it makes subjects more disapproving of abortion. Morbidity salience (i.e. being reminded of chronic illness) was chosen as a stimulus for several reasons. Firstly, it is possible that morbidity salience is more pertinent to people in modern developed societies as the epidemiological transition (Olshansky & Ault, 1986) means that increasing numbers of people experience chronic degenerative illnesses such as diabetes and arthritis which impair quality of life and ability to carry out everyday tasks: this is in contrast to previous eras when life tended to be shorter and infectious illnesses dominated. Secondly, life history theorists have been extremely interested in the research of Geronimus (1992) which suggests that socioeconomically deprived women are informed by their experiences of their female peers' and relatives' ill-health when scheduling reproduction, doing this relatively early in order to mitigate the costs of illness to childbearing and childrearing. Women experience a greater burden of morbidity compared to men, who tend to die younger (Case & Paxson, 2005). Thirdly, in Chapter Two of the current thesis, we demonstrated using a small-area analysis of England and Wales that the higher the prevalence of age-standardised long-term limiting illness in a ward, the lower the proportion of conceptions ended in abortion for the under-25 age band, adjusting for other socioeconomic indicators. Moreover, the difference between the 'abortion proportion' at two standard deviations above and below the morbidity mean was greater than the difference between 'abortion proportion' at two standard deviations above and below the mortality (life expectancy) mean, suggesting that morbidity might be more important than mortality for high-income populations.

4.1.2 Additions for the new experiment

Therefore the current experiment uses cues of both morbidity and mortality salience to investigate their effects on a sample of unmarried childless 18-25-year-olds from England and Wales in terms of their abortion attitudes and other reproduction-related attitudes. The current experiment builds upon the previous one by including similar stimuli, but which this time relate to chronic illness as well as separate stimuli related to death.

As in the previous experiment we measure abortion approval as a dependent variable, measured in general terms using judgements of a hypothetical woman's actions; and in personal terms by asking participants if they thought they/their girlfriend should have an abortion if pregnant now. As before we also measure their interest in having children within the next few years. The new experiment extends the previous one by also using additional dependent variables: Ideal Number of Children, found in previous research (Mathews & Sear, 2008; Wisman & Goldenberg, 2005) to be elevated in men (and sometimes women) under Mortality Salience; and Ideal Age to Start Having Children. Additionally, measures of Subjective Life Expectancy and Subjective Disability-Free Life Expectancy are taken, in order to determine whether the manipulations do make participants feel that they will live shorter lives or experience ill-health at a relatively young age; and whether these experiences are associated with other responses to the reproduction-related questions. Additionally, we also measure whether the experimental stimuli or controls induce a specific emotional response, to further understand mechanisms: this is done by using the Positive And Negative Affect Scale (E. R. Thompson, 2007).

Ultimately the experiment is measuring psychological pro-natalism i.e. promoting reproduction, as life history theory predicts that mortality salience should promote reproductive motivation; and by the same logic so should morbidity salience as it also would shorten the time available for childbearing and child-rearing. Disability-Free Life Expectancy is an objective measure of morbidity used by a number of countries (OECD, 2001), but here a subjective version of it is measured to check how long participants believe they will stay disability-free.

4.1.3 Predictions

It is not easy to judge whether, according to theoretical and empirical logic, Mortality Salience or Morbidity Salience should have the most pro-natal effect compared to the control condition. It might be the case that due to adaptive lag, people are not necessarily evolved to respond to cues about morbidity (as opposed to mortality), as in terms of the epidemiological transition (Olshansky & Ault, 1986) it is only relatively recently in human history and in populations with relatively high wealth and healthcare that sees chronic degenerative disease and disability rather than infectious disease where death came sooner (Van De Water, 1997). Although death presents a greater threat to reproductive capability than does chronic illness, it is also true that in a modern developed nation it is more likely that reproductive-aged individuals would be affected by the latter than the former, and as already mentioned, our geographical analysis in Chapter Two suggested a stronger relationship between morbidity and abortion than between mortality and abortion. Therefore, no predictions are made about the relative size of any pro-natal effect of morbidity and mortality salience, but only about the direction of effect compared to controls. We treat

any emerging effect size differences from the experiment as a topic for discussion.

Researchers interested in how socioeconomic status in developed societies might map onto differences in life history strategy have found that despite their having found no main effects of mortality priming, there was an interaction with subjective childhood socioeconomic status whereby those reared in a relatively impoverished environment were more interested in early parenthood than controls, whereas those reared in a relatively wealthy environment were less interested in this (Griskevicius et al., 2011). We will also test for interactions with socioeconomic status using similar subjective (and also objective) measures, although as such interactions have not been extensively documented, this will be merely exploratory with no hypotheses generated.

Although previous literature has found some evidence of sex differences in responses to Mortality Salience (Mathews & Sear, 2008; Wisman & Goldenberg, 2005), such patterns are not consistent. We do not therefore make predictions about sex differences in our data, but merely explore whether and how far they exist.

HYPOTHESES:

General Abortion Approval Scale and Personal Abortion Approval Scale

Participants in the Mortality Salience condition are expected to score lower on both scales than are controls. We also expect scores in the Morbidity Salience condition to be lower than for controls.

Early Parenthood Approval Scale

We predict that participants in both the Mortality and Morbidity Salience conditions will score higher on this scale than will controls.

Ideal Number of Children

It is expected that participants in both the Mortality and Morbidity Salience conditions will have higher mean values for this than controls.

Ideal Age to start having Children

We expect participants in both treatment conditions to cite an earlier ideal age to start having children than controls.

4.2 Method

Approval was granted prior to the experiment from the Ethics committee of the London School of Hygiene & Tropical Medicine.

4.2.1 Participants

As for the previous experiment, participants were recruited from the Crowdfunder website, which unites surveys and 'microtasking' work with those wanting to do them via consumer research sites. This then routed participants to the SocialSci survey platform which hosted the experimental questionnaire. Participants who were not screened out were all aged 18-25, unmarried, childless, had grown up in England or Wales and were currently living in England or Wales. These criteria meant that the sample was similar to that in the previous experiment so that results could be compared, as well as being similar to the youngest age group in the geographical analysis (Chapter Two). For ethical reasons people were screened out if they were recently bereaved, suffering from chronic illness, were currently or recently pregnant, or had a partner currently or recently pregnant. Online recruitment aimed to minimise

social desirability bias bearing in mind the nature of the questions, and also was an attempt to find a socioeconomically varied sample compared to the undergraduate samples usually used.

4.2.2 Design and procedure

Participants were told they would be answering questions regarding abortion attitudes and reproduction. They were also told they might be asked questions about their general knowledge and attitudes to other topics.

Primes

Once routed to the questionnaire and having got past the screening procedure, participants were exposed to the primes. They were all randomly assigned to one of the three between-subjects conditions, stimuli for which can be seen in Appendix D. The bogus quiz format was chosen for the primes as in the first experiment, due to its online administration and following ethical guidelines from the British Psychological Society (BPS, 2007), it was decided that this would be the least distressing way to expose participants to mortality and morbidity primes in the absence of a face-to-face debrief. It is similar in format to that used by Mathews and Sear (2008). The three conditions were:

1) Morbidity Salience

The Morbidity Salience prime was a bogus quiz including questions on chronic illness statistics and also personal attitudes to the same.

2) Mortality Salience

The Mortality Salience prime was a bogus quiz with questions on death statistics and attitudes to the same. It was identical to the Mortality Salience prime used in the previous experiment.

3) Control (Lost Property)

This control was also a bogus quiz asking questions about lost property statistics and attitudes towards losing things. It is identical to that used in the previous experiment, and was conceived of as a mildly aversive stimulus (so that for participants, all stimuli would be aversive, but would differ regarding whether they mentioned illness or death) which also adhered to ethical guidelines. Its content was similar to the control used by Griskevicius et al. (2011), who had a bogus newspaper story about lost keys.

4.2.3 Positive and Negative Affect Scale

Following the prime, the PANAS (E. R. Thompson, 2007) was included in order to measure whether participants felt significantly different emotions across the two experimental conditions and one control condition. The short version of it was chosen in order to fit concisely into the questionnaire so that any treatment effects would not have worn off by the time respondents were faced with questions forming the response variables. This version has also been cross-culturally validated so is a more robust measure than the earlier version. The words were adapted slightly in order to ask about the present moment, rather than how someone generally feels. It asks, 'thinking about yourself and how you feel right now, to what extent do you feel:

Upset
Hostile
Alert
Ashamed
Inspired
Nervous
Determined
Attentive
Afraid
Active

People are asked to rate themselves on a 1-5 semantic differential scale with 'not at all' at one end and 'extremely' at the other. A semantic differential scale measures people's attitudes towards things by putting opposites at each end of a scale.

4.2.4 Dependent measures

Personal abortion questions:

Female participants were asked, 'if you discovered you were pregnant now, would you have an abortion?' Males were asked, 'if you had a girlfriend who discovered now that she was pregnant by you, do you think she should have an abortion?' In both cases responses were chosen on a seven-point semantic differential scale from 'definitely no' to 'definitely yes' at the two ends.

Early Parenthood Approval Scale:

This was taken from Griskevicius et al. (2011), and comprises three items:

- 1) Would you like to have children in the next few years? (Responses ranging on a five-point scale from 'definitely no' to 'definitely yes')
- 2) If you were to have a child in the next few years, how would you feel? (Responses ranging on a five-point scale from 'feel negative' to 'feel positive')
- 3) How disappointed would you be if you did NOT have a child in the next few years? (Reverse scored, with responses on a five-point scale from 'not at all disappointed' to 'very disappointed')

Then from these three questions a composite score was made from the means for each participant from those who had answered all three questions. The internal reliability gave a Cronbach's alpha of .82.

General Abortion Approval Scale

Participants then read the following: 'there are certain circumstances in which a woman might consider having an abortion. Please say in each of the following cases whether you think it would be acceptable, unacceptable, or somewhere in between for the woman to have an abortion. You can do this by selecting one of the points on the scale'.

Ten questions were then presented of potential scenarios, e.g. 'the woman decides she does not have enough money to support a child'; 'continuing the pregnancy would severely harm the woman's health'. Responses were made on a seven-point semantic differential scale ranging from 'abortion is unacceptable' to 'abortion is acceptable', with some items presenting this scale in a reverse direction to prevent automatic responding. Presentations of all these questions was randomised to prevent fatigue effects. The full list of scenarios is presented in Appendix D. A composite score was created from the means of those who answered all ten items, with a Cronbach's alpha of .82.

Subjective Life Expectancy

Participants who were in the Mortality Salience condition were then asked, 'if you had to take a guess about what age you will be when you die, what would you say?'

Subjective Disability-Free Life Expectancy

Those participants who were in the Morbidity Salience condition were asked, 'until what age do you expect to be healthy and active?'

Demographic questions:

Subjective childhood and current socioeconomic status measures were taken, identical to those used by Griskevicius et al. (2011), as they were found to moderate responses to the Early Parenthood Approval Scale, with those who had grown up poorer having higher scores on this when faced with Mortality Saliency. Objective childhood/adult socioeconomic status (measured with questions on job status/education of participants and their parents) were also assessed.

People were then asked a number of demographic questions, in order to check that random assignment had distributed people with similar characteristics roughly equally across conditions. These comprised questions on cohabitation status; ethnicity; religion; religiosity; and with whom the participant had mostly lived until age 12. Additionally participants were asked about their age at sexual debut; whether they prefer a romantic partner with a high level of education; and whether, if they have a sister or sisters, she has done well at school. These were asked because Weeden (2003) found them predictive of abortion attitudes as described in Section 3.2.4 of this thesis, and so they were included.

After participants had completed the questionnaire, they were debriefed regarding the experimental nature of the questions and the research's background and aims (BPS, 2007, 2010).

4.3 Results

4.3.1 Background characteristics of participants

After exclusion of a couple of participants who had answered only a few questions, 166 participants remained (90 males and 76 females) with a mean age of 21.66 (SD 2.48). Their key background features across the three conditions can be seen in Table 4.1. Of those who answered the question, 65.66% said

they did not have any religious beliefs. Overall, the percentage who were currently students were 29.52% (of those who answered). All who answered the question had some kind of qualifications, and of those 71.7% had had at least AS-levels, A-levels, or an Access course qualification or higher, so most of them had either experienced higher education or were likely to sometime in future.

Table 4.1: selected background demographics of participants across conditions. (Except for total number the percentage figure relates to distribution within each treatment group.) Percentages are rounded up to the nearest integer, and for continuous variables means are used.

CONDITION	MORBIDITY SALIENCE	MORTALITY SALIENCE	LOST PROPERTY CONTROL
Total	Total = 60 (36% of sample)	Total = 55 (33% of sample)	Total = 51 (31% of sample)
Sex	Male=29 (48%) Female=31 (52%)	Male=34 (62%) Female=21 (38%)	Male=27 (53%) Female=24 (47%)
Age (years)	Mean = 21.83	Mean = 21.25	Mean = 21.90
Current Country	England=56 (93%) Wales=4 (7%)	England=45 (82%) Wales=10 (18%)	England=48 (94%) Wales=3 (6%)
Childhood Country	England=58 (97%) Wales=2 (3%)	England=47 (85%) Wales=8 (15%)	England=48 (94%) Wales=3 (6%)
Ethnicity	White British=49 (82%) White Irish=1 (2%) White Other=1 (2%) Mixed White and Black Caribbean=1 (2%) Mixed White and Asian=1 (2%) Any other mixed background=1 (2%) Chinese=3 (5%) Prefer not to say=3 (5%)	White British=45 (82%) Mixed White and Black Caribbean=2 (4%) Mixed White and Asian=1 (2%) Asian/Asian British Pakistani=1 (2%) Asian/Asian British Bangladeshi=2 (4%) Black/Black British Caribbean=1 (2%) Chinese=1 (2%) Prefer not to say =2 (4%)	White British=41 (80%) White Irish=1 (2%) White Other=2 (4%) Mixed White and Black Caribbean=2 (4%) Mixed White and Asian=2 (4%) Asian/Asian British Indian=2 (4%) Any other ethnic group=1 (2%)
Do you have religious beliefs?	No=42 (70%) Yes=16 (27%) Prefer not to say =2 (3%)	No=31 (56%) Yes=22 (40%) Prefer not to say =2 (4%)	No=36 (71%) Yes=14 (27%) Prefer not to say =1 (2%)
Religion	Prefer not to answer=1 (2%) Christian=14 (23%) Muslim=1 (2%) Missing=44 (73%)	Prefer not to answer=1 (2%) Christian=16 (29%) Muslim=3 (5%) Jewish=1 (2%) Other (includes agnostic and 'kind of Christian agnostic') = 2 (4%) Missing=32 (58%)	Christian=13 (25%) Muslim=1 (2%) Missing=37 (73%)
Strength of religious beliefs	1 Very weak =0 (0%) 2=7 (12%) 3=3 (5%) 4=6 (10%) 5 Very strong =2 (3%) Missing=42 (70%)	1 Very weak =2 (4%) 2=3 (5%) 3=9 (16%) 4=6 (11%) 5 Very strong =3 (5%) Missing=32 (58%)	1 Very weak =1 (2%) 2=2 (4%) 3=6 (12%) 4=3 (6%) 5 Very strong =2 (4%) Missing=37 (73%)

CONDITION	MORBIDITY SALIENCE	MORTALITY SALIENCE	LOST PROPERTY CONTROL
Cohabiting	No=40 (67%) Yes=20 (33%) Missing=0(0%)	No=31 (56%) Yes=24 (44%) Missing=0(0%)	No=33 (65%) Yes=18 (35%) Missing=0 (0%)
Current job type	Student=18 (30%) Unemployed=6 (10%) Unskilled manual=6 (10%) Skilled manual=3 (5%) Clerical = 24 (40%) Missing=3 (5%)	Student=15 (27%) Unemployed=4 (7%) Unskilled manual=7 (13%) Skilled manual=4 (7%) Clerical = 24 (44%) Missing=1 (2%)	Student=16 (31%) Unemployed=2 (4%) Unskilled manual=6 (12%) Skilled manual=3 (6%) Clerical = 21 (41%) Missing=3 (6%)
Current highest qualification	No qualifications=0 (0%) Fewer than 5 GCSEs A-C grade = 1 (2%) 5 or more GCSEs A-C grade =12 (20%) Foundation degree or NVQ Level 4 or 5 = 3 (5%) AS-level, A-level, Access course = 19 (32%) Bachelor's degree or teaching qualification = 16 (27%) Master's degree = 6 (10%) Doctorate = 1 (2%) Missing =2 (3%)	No qualifications=1 (2%) Fewer than 5 GCSEs A-C grade = 2 (4%) 5 or more GCSEs A-C grade = 7 (13%) Foundation degree or NVQ Level 4 or 5 = 2 (4%) AS-level, A-level, Access course = 16 (29%) Bachelor's degree or teaching qualification = 15 (27%) Master's degree = 7 (13%) Doctorate = 1 (2%) Missing =4 (7%)	No qualifications=1 (2%) Fewer than 5 GCSEs A-C grade =5 (10%) 5 or more GCSEs A-C grade =7 (14%) Foundation degree or NVQ Level 4 or 5 = 4 (8%) AS-level, A-level, Access course = 14 (27%) Bachelor's degree or teaching qualification = 14 (27%) Master's degree = 4 (8%) Doctorate = 1 (2%) Missing =1 (2%)
Highest-paid job of highest-earning parent up to age 12	Unemployed = 0 (0%) Unskilled manual = 7 (12%) Skilled manual = 10 (17%) Clerical = 9 (15%) Professional = 27 (45%) Missing = 7 (12%)	Unemployed = 1 (2%) Unskilled manual = 5 (9%) Skilled manual = 16 (29%) Clerical = 13 (24%) Professional = 15 (27%) Missing = 5 (9%)	Unemployed = 0 (0%) Unskilled manual = 7 (14%) Skilled manual = 14 (27%) Clerical = 4 (8%) Professional = 20 (39%) Missing = 6 (12%)
Housing tenure up to age 12	Rented=14 (23%) Owned=39 (65%) Missing=7 (12%)	Rented=15 (27%) Owned=34 (62%) Missing=6 (11%)	Rented=11 (22%) Owned=36 (71%) Missing=4 (8%)
Moved house due to money problems up to age 12	Did not move=46 (77%) Moved=7 (12%) Missing=7 (12%)	Did not move=42 (76%) Moved=8 (15%) Missing=5 (9%)	Did not move=42 (82%) Moved=7 (14%) Missing=2 (4%)
Prefer a romantic partner with a high level of education	No=13 (22%) Yes=39 (65%) Missing=8 (13%)	No=14 (25%) Yes=38 (69%) Missing=3 (5%)	No=9 (18%) Yes=36 (71%) Missing=6 (12%)
Do you have any sisters?	No=34 (57%) Yes=26 (43%) Missing=0 (0%)	No=29 (53%) Yes=26 (47%) Missing=0 (0%)	No=28 (55%) Yes=23 (45%) Missing=0 (0%)

CONDITION	MORBIDITY SALIENCE	MORTALITY SALIENCE	LOST PROPERTY CONTROL
In general, do/es your sister/s do well at school?	No=5 (8%) Yes=19 (32%) Missing=36 (60%)	No=3 (5%) Yes=23 (42%) Missing=29 (53%)	No=5 (10%) Yes=18 (35%) Missing=28 (55%)
Do you have any brothers?	No=21 (35%) Yes=38 (63%) Missing=1 (2%)	No=28 (51%) Yes=27 (49%) Missing=0 (0%)	No=25 (49%) Yes=25 (49%) Missing=1 (2%)
In general, do/es your brother/s do well at school?	No=8 (13%) Yes=28 (47%) Missing=24 (40%)	No=8 (14%) Yes=17 (31%) Missing=30 (55%)	No=7 (14%) Yes=18 (35%) Missing=26 (51%)
With whom did you mostly live until age 12?	Both biological parents=42 (70%) Biological father only=1 (2%) Biological mother only=8 (13%) Biological father and stepmother=1 (2%) Biological father and adopted mother=1 (2%) Stepfather and biological mother=4 (7%) Grandparents=2 (3%) Missing=1 (2%)	Both biological parents=38 (69%) Biological father only=1 (2%) Biological mother only=9 (16%) Biological father and stepmother=3 (5%) Grandparents=1 (2%) Missing=3 (5%)	Both biological parents=37 (73%) Biological father only=1 (2%) Biological mother only=3 (6%) Biological father and stepmother=2 (4%) Stepfather and biological mother=2 (4%) Other relatives=1 (2%) Missing=5 (10%)
Subjective childhood SES (Higher values indicate higher subjective childhood SES) N=166	Mean= .0051	Mean= -.0340	Mean= .0306
Subjective current and future SES (Higher values indicate higher subjective current/future SES) N=165	Mean= -.0653	Mean= .0111	Mean= .0661
Have you started to have sexual relationships?	No=12 (20%) Yes=45 (75%) Missing=3 (5%)	No=16 (29%) Yes=35 (64%) Missing=4 (7%)	No=7 (14%) Yes=43 (84%) Missing=1 (2%)
Age of sexual debut	Missing =13 (22%) Mean= 17.15	Missing =21 (38%) Mean= 17.29	Missing = 8 (16%) Mean= 17.05

Following chi-square tests and one-way ANOVAs (not shown) it was found that there were no differences found between any of the conditions in the

distribution of background characteristics listed in Table One, and random allocation had worked correctly.

Responses for all dependent variables were analysed separately by sex. This was done using linear regression with the control condition (lost property) as the reference category and the two treatment conditions coded as dummy variables to test if their means were significantly different from controls (Field, 2013). As all dependent variables had non-normal distribution of residuals (despite homogeneity of variance), standard errors were bootstrapped with 50 replications to make p-values more reliable (Wright et al., 2011).

4.3.2 'Mechanistic' variables

Firstly we looked at the effect of treatment (by sex) on variables which might be thought to provide a mechanism for any experimental effects. If Morbidity Salience has any experimental effect it might be assumed theoretically speaking to be via the pathway of shortened Subjective Disability-Free Life Expectancy (SDFLE). Similarly, if Mortality Salience has an experimental effect it might be via the pathway of relatively short (compared to controls) Subjective Life Expectancy (SLE). Measuring both also acted as a manipulation check on the experimental treatments. The results of the Positive and Negative Affect Scales were then investigated to see what emotions participants were feeling shortly after the experimental manipulations, to further understand the mechanism of any treatment effects.

Mean SDFLE (in years) for Males in the Morbidity Salience condition was 61.82; and in the control condition 63.32, showing there was a trend towards shorter SDFLE in the treatment condition as expected, but this was not significant ($\beta = -1.499$; $z = -0.35$, $p = 0.739$). For Females in the Morbidity Salience condition,

mean SDFLE was 59; and in the control condition was 60.64, again in the expected direction, but these were not significantly different ($\beta = -1.636$; $z = -0.33$, $p = 0.670$).

Next we tested Subjective Life Expectancy in the same way. For males in the Mortality Salience condition, SLE was 76.6 and in the control condition 77.17. This meant that the treatment had the expected effect of decreasing SLE, but not to a statistically significant extent ($\beta = -.567$, $z = -0.11$, $p = 0.889$). For females in the Mortality Salience condition, SLE was 77.47 and in the control condition 75, showing that the treatment did not have any effect in the expected direction and the result was not significant ($\beta = 2.471$; $z = 0.42$, $p = 0.626$).

The Positive and Negative Affect Scale was analysed separately by sex using linear regression with bootstrapped standard errors as before, due to non-normal residual distribution. Each emotion (listed in Section 4.2.3 earlier) was tested separately with the treatment conditions as dummy variables and the control condition as the baseline. The only significant results were that in the Mortality Salience condition, males were less alert than in the control condition ($\beta = -.490$; $z = -2.15$, $p = 0.031$); and in the Morbidity Salience condition, females were more afraid than in the control condition ($\beta = .726$; $z = 2.35$, $p = 0.014$). This means that for the other emotion descriptors measured by the PANAS (upset; hostile; ashamed; inspired; nervous; determined; attentive; active) there were no significant treatment effects for either sex.

We have rather weak evidence, then, that the primes had much effect on participants in terms of the 'mechanistic' variables: though morbidity and mortality salience tended to have the expected effect on disability-free (for both

sexes) and overall life expectancy (for males only), these effects were not significant, and priming had little effect on mood other than to make males reportedly less alert under Mortality Salience and Females more afraid under Morbidity Salience.

Next we tested our hypotheses, by investigating the effects of both Morbidity and Mortality Salience (compared to the Lost Property control) on the main dependent variables.

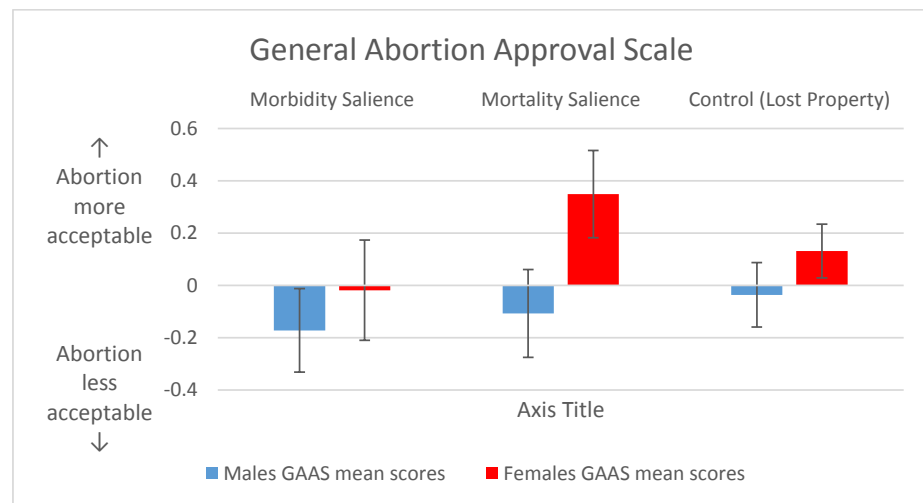
4.3.3 Abortion approval (general and personal)

Scores on the General Abortion Approval Scale (GAAS, answered by both males and females) were then investigated. Scores on individual items on the scale were standardised where participants had answered all of the ten questions, meaning that of the 166 total participants, only 161 had their responses feeding into this dependent variable. The resulting composite variable taken from means had an overall Cronbach's Alpha of 0.83. Thus neutrality vis-à-vis abortion would score zero; relative approval would score above zero; and relative disapproval would score less than zero.

Mean score on the GAAS for males was -.172 in the Morbidity Salience condition; -.108 in the Mortality Salience condition; and -.037 in the control condition. This meant that under Morbidity Salience abortion approval was lower than in the control condition and the Mortality Salience condition. However, neither treatment condition was significantly different from the control (Morbidity Salience $\beta = -.136$; $z = -0.99$; $p = 0.312$; Mortality Salience $\beta = -.071$; $z = -0.65$; $p = 0.621$).

For females, the mean GAAS score was $-.019$ in the Morbidity Salience condition; $.349$ in the Mortality Salience condition; and $.131$ for controls), showing that Morbidity Salience was the condition where they approved of abortion least and Mortality Salience was where they approved of abortion most. Nonetheless, these differences were not significant (Morbidity Salience $\beta = -.150$; $z = -0.93$; $p = 0.392$; Mortality Salience $\beta = .218$; $z = 1.43$; $p = 0.215$). The results can be seen in Figure 4.1.

Figure 4.1: General Abortion Approval Scale means by sex across experimental and control conditions: no effects for either sex

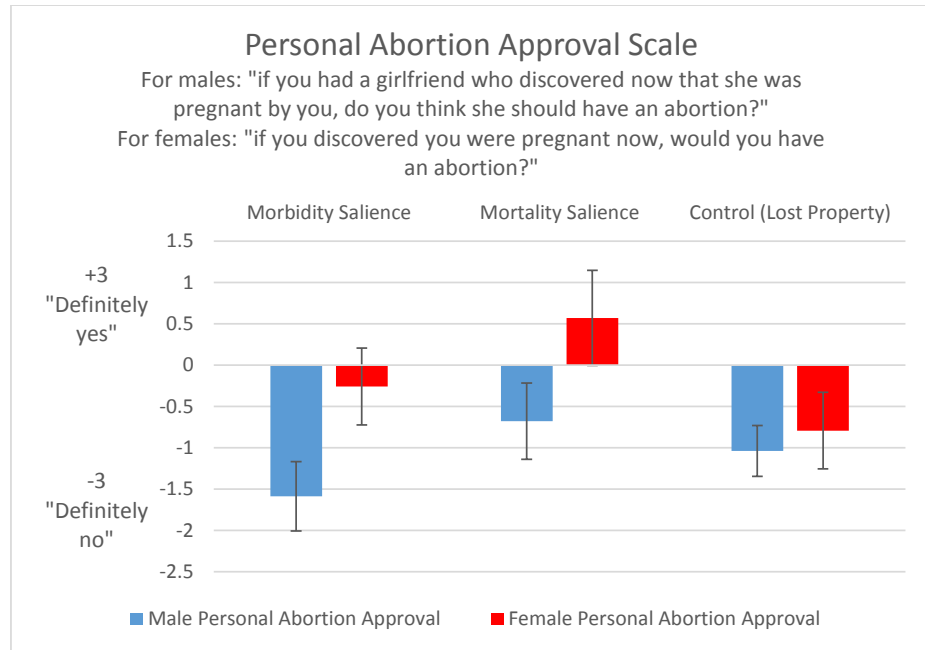


Experimental condition had no significant effect on the GAAS for either sex. For both sexes, the trend was for Morbidity Salience to elicit the lowest abortion approval. For males Mortality Salience meant lower abortion approval than for controls; and for females Mortality Salience meant higher abortion approval than for controls.

The more personal abortion approval questions, asked separately for each sex, were then examined. Men were asked: “if you had a girlfriend who discovered now that she was pregnant by you, do you think she should have an abortion?”

Just one male did not answer this question and therefore his answers could not be analysed. Women were asked “If you discovered you were pregnant now, would you have an abortion?” Both questions were scored from -3 “definitely no” to +3 “definitely yes”. Mean scores of Male Personal Abortion Approval were, in each condition: Morbidity Salience=-1.586; Mortality Salience=-.676; and Lost Property control=-1.04, showing a trend whereby abortion was approved of least in the Morbidity Salience condition and most in the Mortality Salience condition, although all scores were lower than zero. There was no significant difference between conditions (Morbidity Salience $\beta = -.548$; $z = -1.39$; $p=0.286$; Mortality Salience $\beta = .362$; $z = 0.74$; $p=0.464$) For females, the mean scores were the following: Morbidity Salience=-.258; Mortality Salience=.571; and Lost Property control=-.792, showing that the highest personal abortion approval was in the Mortality Salience condition as for men; and the lowest abortion approval was in the control condition. Regression showed that compared to the control condition, Mortality Salience produced significantly higher abortion approval ($\beta = 1.363$; $z = 2.04$; $p=0.029$), whereas there was no significant difference between Morbidity Salience and control ($\beta = .534$; $z=0.86$; $p=0.341$). Results for both sexes are shown in Figure 4.2.

Figure 4.2: Females show significantly higher personal abortion approval (“If you discovered you were pregnant now, would you have an abortion?”) in mortality salience condition compared to controls

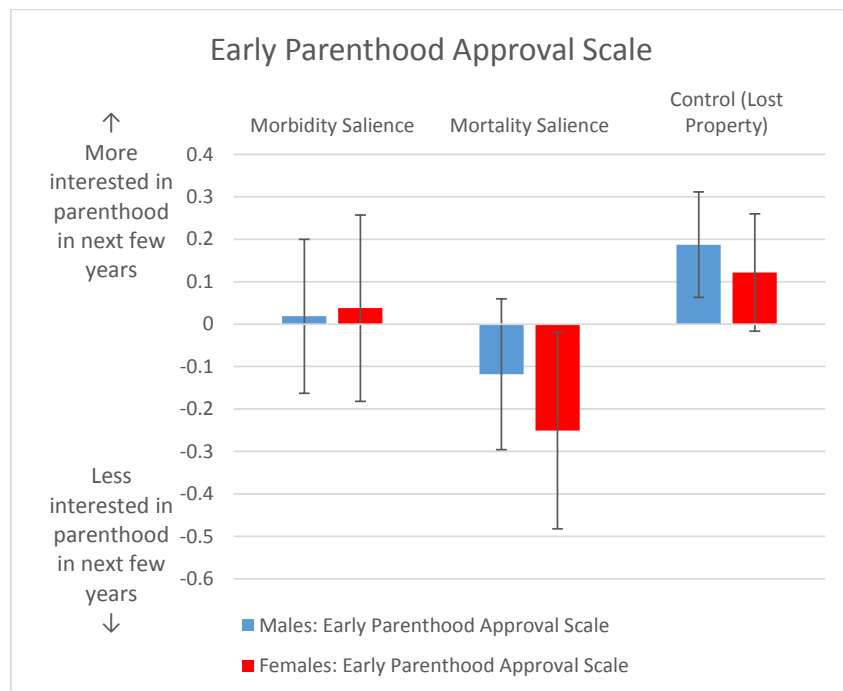


4.3.4 Early Parenthood Approval Scale

A composite variable for Early Parenthood Approval Scale was created for the three items, as long as participants had answered all three questions. Of the 90 men, three had not answered all three questions and so were not included in this variable. All of the 76 women had supplied all three responses for this variable. The items were standardised as for the General Abortion Approval Scale, and the resulting composite variable had a Cronbach’s Alpha of .82. For males, mean EPAS scores were .019 in the Morbidity Salience condition; -.118 for Mortality Salience; and .187 for controls, showing that men were least likely to want to become parents soon under Mortality Salience; and were most interested in parenthood soon in the control condition. These differences were not significant, however (Morbidity Salience $\beta = -.169$; $z = -0.79$; $p=0.341$. Mortality Salience $\beta = -.305$; $z = -1.30$; $p=0.127$). For females, EPAS score means

were .038 under Morbidity Saliencie; -.251 under Mortality Saliencie; and .122 for controls, showing that interest in parenthood soon was strongest in the control condition and weakest when asked to think about death. The results were not statistically significant (Morbidity Saliencie $\beta = -.084$; $z = -0.36$; $p = 0.750$. Mortality Saliencie $\beta = -.373$; $z = -1.31$; $p = 0.169$). For this variable then, there were no significant treatment effects for either sex, though the trend is for Mortality Saliencie to make both males and females less pro-natal. Morbidity Saliencie has a similar, though weaker, effect. Figure 4.3 shows the effect for both sexes across conditions.

Figure 4.3: Early Parenthood Approval Scale by sex across conditions

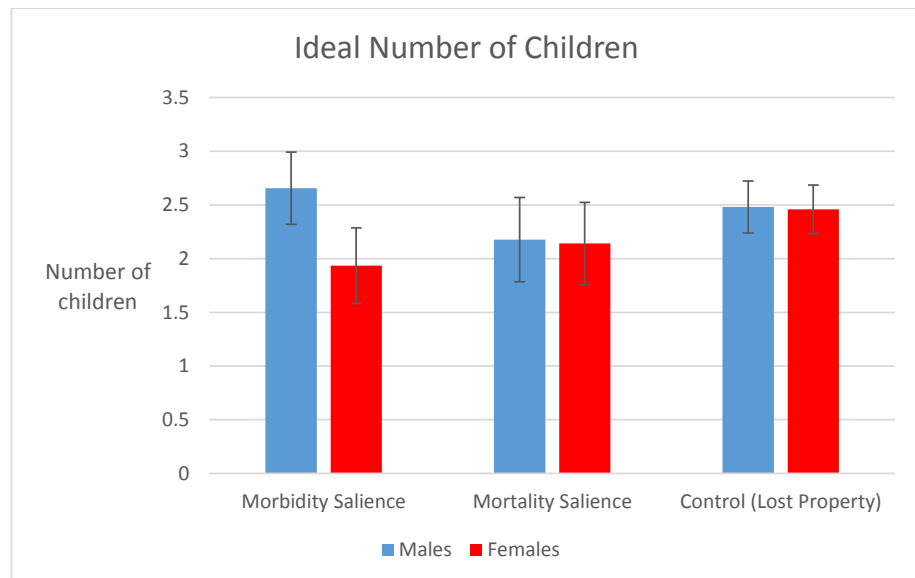


4.3.5 Ideal Number of Children

All participants, both male and female, had answered this question. Mean ideal number of children for males were: Morbidity Saliencie 2.66; Mortality Saliencie 2.18; Lost Property control 2.48, the highest number therefore in the Morbidity

Saliency condition and the fewest under Mortality Saliency. These differences were not significant (Morbidity Saliency $\beta=.174$; $z= 0.48$; $p=0.633$; Mortality Saliency $\beta= -.305$; $z= -0.75$; $p=0.633$). Mean ideal number of children for females was Morbidity Saliency 1.94; Mortality Saliency 2.14; and Lost Property control 2.46, showing that females were least pro-natal when thinking of chronic illness, and most in the control condition. These differences were not significant either (Morbidity Saliency $\beta=-.523$; $z= -1.75$; $p=0.145$; Mortality Saliency $\beta= -.315$; $z= -0.93$; $p=0.400$). Figure 4.4 shows these results.

Figure 4.4: Ideal number of children by sex across conditions

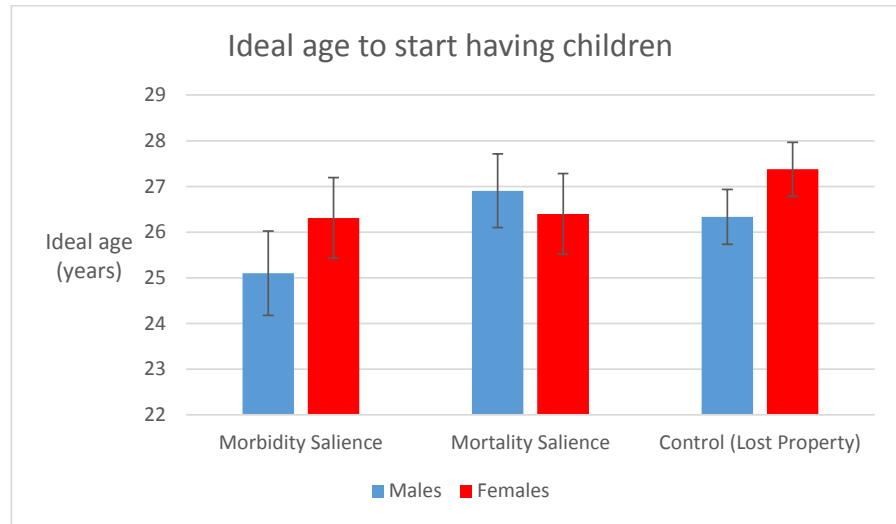


4.3.6 Ideal age to start having children

Two of the 90 male participants had not answered this question; and of the 76 female participants, three had not answered this question. For males, the mean scores for each condition on this variable were: Morbidity Saliency 25.10; Mortality Saliency 26.91; and control 26.33. Morbidity Saliency elicited the most pro-natal response, and Mortality Saliency the least. These differences were too slight to be significant (Morbidity Saliency $\beta= -1.230$; $z= -1.45$; $p=0.178$;

Mortality Salience $\beta = .573$; $z = 0.60$; $p = 0.536$). For females the mean scores were: Morbidity Salience 26.31; Mortality Salience 26.4; and control 27.38, showing that Morbidity Salience elicited the youngest ideal age, and the control the oldest, but the differences were not significant (Morbidity Salience $\beta = -1.065$; $z = -1.68$; $p = 0.212$; Mortality Salience $\beta = -.975$; $z = -1.43$; $p = 0.349$). Figure 4.5 shows the results by sex across conditions.

Figure 4.5: Ideal Age to Start Having Children by sex across conditions



4.3.7 Support for hypotheses

In terms of the hypotheses stated earlier, here is how the results measured up, in Tables 4.2, 4.3, 4.4, 4.5 and 4.6:

Table 4.2 How far did results for General Abortion Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Morbidity Saliency: Abortion Approval is expected to be lower in this condition than the control.	No. Although Abortion Approval was lower in this condition than for controls as predicted, this difference was not significant.	No. Although Abortion Approval was lower in this condition than for controls, this difference was not statistically significant.
Mortality Saliency: Abortion Approval is expected to be lower in this condition than for controls.	No. Abortion Approval was lower in this condition than for controls as predicted, but this difference was not statistically significant.	No. Abortion Approval was higher in this condition than for controls (though the difference was not significant. This ran counter to predictions.
Actual order of results across Morbidity Saliency, Mortality Saliency and control.	HIGHEST ABORTION APPROVAL: Controls. MIDDLE ABORTION APPROVAL: Mortality Saliency LOWEST ABORTION APPROVAL: Morbidity Saliency	HIGHEST ABORTION APPROVAL: Mortality Saliency MIDDLE ABORTION APPROVAL: Controls LOWEST ABORTION APPROVAL: Morbidity Saliency

Table 4.3: How far did results for Personal Abortion Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Morbidity Saliency: Abortion Approval is expected to be lower in this condition than for controls	No. Although Abortion Approval is lower in this condition than for controls, this difference is not statistically significant.	No. This condition did not elicit significantly lower Abortion Approval than for controls, instead producing higher Abortion Approval (though to a non-significant extent).
Mortality Saliency: Abortion Approval is expected to be lower in this condition than for controls	No. Mortality Saliency actually elicits higher Abortion Approval than for controls, although the difference is not statistically significant.	No. This condition meant higher Abortion Approval than for controls, counter to predictions. This difference was also statistically significant.
Actual order of results across Morbidity Saliency, Mortality Saliency and control.	HIGHEST ABORTION APPROVAL: Mortality Saliency MIDDLE ABORTION APPROVAL: Controls LOWEST ABORTION APPROVAL: Morbidity Saliency	HIGHEST ABORTION APPROVAL: Mortality Saliency MIDDLE ABORTION APPROVAL: Morbidity Saliency LOWEST ABORTION APPROVAL: Controls

Table 4.4: how far did results for Early Parenthood Approval Scale support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Morbidity Salience: Early Parenthood Approval is hypothesised to be higher in this condition than for controls.	No. Early Parenthood Approval was lower (though not significantly so) than for controls. This was in the opposite direction to predictions.	No. Early Parenthood Approval was lower in this condition than for controls (though not significantly so).
Mortality Salience: Early Parenthood Approval is hypothesised to be higher in this condition than for controls.	No. Early Parenthood Approval was lower (though not significantly so) than for controls. This was in the opposite direction to predictions.	No. Early Parenthood Approval was lower in this condition than for controls (though not significantly so).
Actual order of results across Morbidity Salience, Mortality Salience and control.	HIGHEST EARLY PARENTHOOD APPROVAL: Controls MIDDLE EARLY PARENTHOOD APPROVAL: Morbidity Salience LOWEST EARLY PARENTHOOD APPROVAL: Mortality Salience	HIGHEST EARLY PARENTHOOD APPROVAL: Controls MIDDLE EARLY PARENTHOOD APPROVAL: Morbidity Salience LOWEST EARLY PARENTHOOD APPROVAL: Mortality Salience

Table 4.5: how far did results for Ideal Number of Children support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Morbidity Salience: Ideal Number of Children is expected to be higher in this condition than for controls.	No. Although Ideal Number of Children was marginally higher in this condition than for controls, this difference is not statistically significant.	No. Ideal Number of Children is actually lower in this condition than for controls, though not significantly so.
Mortality Salience: Ideal Number of Children is expected to be higher in this condition than for controls.	No. Ideal Number of Children was lower than for controls in this condition (though not significantly so). The direction of this effect was counter to predictions.	No. Ideal Number of Children is lower in this condition than for controls (counter to predictions), though not significantly so.
Actual order of results across Morbidity Salience, Mortality Salience and control.	HIGHEST IDEAL NO. OF CHILDREN: Morbidity Salience MIDDLE IDEAL NO. OF CHILDREN: Controls LOWEST IDEAL NO. OF CHILDREN: Mortality Salience	HIGHEST IDEAL NO. OF CHILDREN: Controls MIDDLE IDEAL NO. OF CHILDREN: Mortality Salience LOWEST IDEAL NO. OF CHILDREN: Morbidity Salience

Table 4.6: how far did results for Ideal Age to Start Having Children support the hypotheses?

Predictions:	MALES: was hypothesis supported?	FEMALES: was hypothesis supported?
Morbidity Salience: Ideal Age to Start Having Children is expected to be lower in this condition than for controls.	No. Although the ideal age was lower in this condition than for controls, the difference was not statistically significant.	No. Although the ideal age was lower in this condition than for controls, the difference was not statistically significant.
Mortality Salience: Ideal Age to Start Having Children is expected to be lower in this condition than for controls.	No. The ideal age in this condition was actually higher (though not significantly so) than for controls, running counter to predictions.	No. Although the ideal age was lower in this condition than for controls, the difference was not statistically significant.
Actual order of results across Morbidity Salience, Mortality Salience and control.	HIGHEST IDEAL AGE TO START HAVING CHILDREN: Mortality Salience MIDDLE IDEAL AGE TO START HAVING CHILDREN: Controls LOWEST IDEAL AGE TO START HAVING CHILDREN: Morbidity Salience	HIGHEST IDEAL AGE TO START HAVING CHILDREN: Controls MIDDLE IDEAL AGE TO START HAVING CHILDREN: Mortality Salience LOWEST IDEAL AGE TO START HAVING CHILDREN: Morbidity Salience

Therefore none of the hypotheses were supported. In some cases the direction of trends was as predicted: the responses of men on the General Abortion Approval Scale and female responses to Ideal Age to Start Having Children are the most consistent example of this. However, the lack of statistical significance means that it is impossible to know whether this occurred merely by chance.

The only dependent variable which saw a significant effect of experimental condition was Female Personal Abortion Approval, where Mortality Salience showed significantly higher scores compared to the control, although this was in the opposite direction to that hypothesised. In terms of general trends, Morbidity Salience made both sexes the most pro-natal in terms of the lowest General Abortion Approval. For the same variable, Mortality Salience made males more anti-abortion than controls; but females more pro-abortion than

controls. The Personal Abortion Approval questions showed that abortion was approved of most for both sexes in the Mortality Salience condition; but under Morbidity Salience males approved of abortion less than controls, while females approved of abortion more than controls. Mortality Salience made both sexes the least interested in imminent parenthood (measured with the Early Parenthood Approval Scale) and Morbidity Salience had similar effects, though more weakly. Men wanted the highest number of children in the Morbidity Salience condition and the lowest number in the Mortality Salience condition; while females wanted most children in the control condition and then seemed less enthusiastic in the treatment conditions, with the lowest mean in the Morbidity Salience condition. In terms of the Ideal Age To Start Having Children, the lowest mean age was reported for men in the Morbidity Salience condition; and the highest age in the Mortality Salience condition. For women, Morbidity Salience also elicited the lowest mean age, but the control condition elicited the highest.

Table 4.7 summarises the trends in terms of pro-natalism and statistical significance. The results are symbolised by pro-natal (+) and anti-natal (-) effects. Pro-natal is where there is an increased desire to have children (e.g. by becoming more anti-abortion), to have them sooner, or to have more of them. Anti-natalism is the opposite. As a broad summary, treatment priming tends to lead to more disapproval of abortion/more pro-natal attitudes in three of the four conditions for General Abortion Attitudes (both primes for men and morbidity priming for women), which is in the direction predicted by the hypothesis. The opposite was true for the effects of priming on personal abortion attitudes, however (i.e. 3 of 4 treatments led to more approval of

abortion/less pro-natalism). When considering all dependent variables, the general trend was for both priming treatments to have the opposite effect to that predicted for women, who became less pro-natal under most treatments. For men, the picture differed according to the prime: men primed with mortality were, like the women, less pro-natal; but priming with morbidity tended to make them more pro-natal. In terms of the impact of mortality salience, however, even if we ignore statistical significance then and just look at the trends, we find no support for our main hypothesis that it will shift attitudes to become more pro-natal.

Table 4.7: Summary of Direction and Significance Level in terms of Pro-Natalism of main Experimental Effects for Males and Females Compared to Controls

	MORBIDITY SALIENCE					MORTALITY SALIENCE				
	General Abortion Approval Scale	Personal Abortion Approval Scale	Early Parenthood Approval Scale	Ideal Number Of Children	Ideal Age To Start Having Children	General Abortion Approval Scale	Personal Abortion Approval Scale	Early Parenthood Approval Scale	Ideal Number Of Children	Ideal Age To Start Having Children
MALES										
Pro-natal (+) or anti-natal? Significant (p-value) or non-significant (NS)?	+	+	-	+	+	+	-	-	-	-
Strength of effect compared to other treatment if in same direction	Stronger pro-natal effect than under Mortality Salience		Weaker anti-natal effect than under Mortality Salience			Weaker pro-natal effect than under Morbidity Salience		Stronger anti-natal effect than under Morbidity Salience		
FEMALES										
Pro-natal (+) or anti-natal? Significant (p-value) or non-significant (NS)?	+	-	-	-	+	-	p=0.029	-	-	+
Strength of effect compared to other treatment if in same direction		Weaker anti-natal effect than under Mortality Salience	Weaker anti-natal effect than under Mortality Salience	Stronger anti-natal effect than under Mortality Salience	Stronger pro-natal effect than under Mortality Salience		Stronger anti-natal effect than under Morbidity Salience	Stronger anti-natal effect than under Morbidity Salience	Weaker anti-natal effect than under Morbidity Salience	Weaker pro-natal effect than under Morbidity Salience

4.3.8 Interactions between condition and socioeconomic status (SES) on each dependent variable

We tested interactions between experimental condition and different types of socioeconomic status (childhood/current; subjective/objective), following previous research which found interactions between Mortality Salience and Subjective Childhood Socioeconomic Status in their effects on the Early Parenthood Approval Scale (Griskevicius et al., 2011) and looking at effects on all our dependent variables: General Abortion Approval Scale; Male Personal Approval Scale; Female Personal Approval Scale; Early Parenthood Approval Scale; Ideal Number of Children; and Ideal Age to Start Having Children.

We looked at four types of socioeconomic status:

- 1) Subjective Childhood Socioeconomic Status
- 2) Subjective Current/Future Socioeconomic Status

These two measures were constructed in the same way as did Griskevicius et al. (2011), using the six items described in Section 3.2.4 of this thesis. A Principal Components Analysis was done of their six items. Two components had eigenvalues over 1 (3.23 and 1.02). Oblimin rotation found simple structure; and rotated Component One loaded on the childhood SES items (loadings ranging from 0.53 to 0.61), accounting for 40% of item variance; and rotated Component Two loaded on the current/future items (0.51-0.67), accounting for 33% of item variance. They had moderate correlation ($r=0.48$). Composite scores were created from each, with Cronbach's Alpha for Subjective Childhood SES being .83 and that for Subjective Current/Future SES being .75. Each measure was standardised.

- 3) Objective Childhood SES: measured by the highest-paid job status of the participant's highest-earning parent during childhood, and came in

5 categories: 1=unemployed; 2= unskilled manual; 3= skilled manual; 4= Clerical/Administrative; 5= Professional/Managerial.

- 4) Objective Current Socioeconomic Status: current completed qualification level. Given the age of our participants, this actually correlated less with age than did current job status and so was less likely to be confounded by it. To inspect interactions it was recoded to six levels (from eight) as there were low frequencies in the lowest and highest qualification categories. The lowest category, 1, now means up to 5 GCSEs A-C including no qualifications; the highest category, 6, means Masters or Doctorate. The other categories were 2: 5 or more GCSEs A-C; 3: National Vocational Qualification (NVQ) Level 4 or 5; 4: AS-Level, A-Level or Access course; 5: Bachelor's degree or teaching qualification.

Just one of these interactions was significant at the 5% alpha level in terms of the effects on a dependent variable.

- In the Mortality Saliency condition, as objective childhood SES increased, male personal abortion approval decreased ($\beta = -.894$; $z = -1.85$; $p = 0.041$).

However, once this was more thoroughly investigated, it was apparent that this was a result of there being very few male participants whose parents had been unemployed or held unskilled manual jobs compared to professional jobs. Additionally there was no similar significant interaction affecting Subjective Life Expectancy which might have underlain it. It is possible that having checked so many interactions, this one was significant merely by chance. Overall, therefore, we find no support here for Griskevicius et al. (2011)'s findings that childhood SES moderates fast/slow life history strategy.

4.4 Discussion

The only statistically significant result found from this experiment was that in the mortality saliency condition compared to the control condition, females were more approving of abortion, in contrast to our prediction that mortality saliency would result in more pro-natal attitudes (i.e. less approval of abortion).

This was specifically when their attitudes were measured on the Personal Abortion Approval Scale i.e. when they were asked whether they would have an abortion if they found out they were pregnant now and given a range of responses from “definitely no” to “definitely yes”. Therefore being reminded of death contributed to greater anti-natalism. However, it is important to be cautious about this result as it was not found under Mortality Salience in our previous experiment, described in Chapter Three. There were no significant effects of Morbidity Salience. It is possible that for both the main reproduction-related variables and for the mechanistic variables (discussed later) there was insufficient statistical power to detect effects, as there do seem to be some general patterns.

4.4.1 Non-significant trends

Therefore it is worth a quick look at the main non-significant trends emerging from the experiment, shown in Table Two. Morbidity Salience seems to have pushed male responses in a more pro-natal direction as predicted, making them less approving of abortion, interested in a higher ideal number of children and a younger ideal age to start having children. The exception is Early Parenthood Approval Scale, which asks about becoming a parent “in the next few years”, perhaps the most concrete measure for male reproductive motivation. Mortality Salience, however, elicited mostly anti-natalism from men (with the exception of General Abortion Approval Scale), contrary to theoretical expectations. Where responses were in the same direction for males in both treatments, Morbidity Salience meant weaker anti-natal and stronger pro-natal responses than Mortality Salience. Morbidity Salience appears to beat Mortality Salience in increasing male reproductive motivation, which, if this is a genuine

effect, is surprising given that death is a greater threat to reproduction than chronic illness.

Women appeared to show more anti-natal sentiment than men in both conditions, perhaps reflecting the greater costs of parenthood for them. Morbidity Salience was only associated with a pro-natal drift regarding the Ideal Age To Start Having Children, where an earlier start might indeed mitigate the costs of childbearing while ill or disabled (Geronimus, 1996b); and with General Abortion Approval Scale, judging the actions of a third party woman. This mostly anti-natal drift was contrary to predictions. Mortality Salience elicited almost completely anti-natal female responses (including the only statistically significant response), again contrary to predictions, with again the exception of a younger Ideal Age To Start Having Children. Where both treatments were associated with the same direction of effect, it was mostly Morbidity Salience giving weaker anti-natal or stronger pro-natal responses than Mortality Salience, similar to the men.

It has sometimes been seen in the previous relevant mortality salience research that enhanced reproductive motivation is only experienced by male participants (Mathews & Sear, 2008) and that females are more cautious in this respect, only exhibiting it under certain conditions (Wisman & Goldenberg, 2005). Even in the current results, males are overall more pro-natal than females, if non-significant trends are taken into account.

4.4.2 Possible reasons for hypotheses not being upheld

Given that the only significant result (and many of the non-significant results) go against predictions, how can we explain this? Firstly there are greater costs to reproduction for women than men, and it is they who exhibit the most anti-

natalism here. There are not only the physical, emotional and financial costs of childbearing and childrearing even in a good situation as many women are aware, but concerns about them might be stimulated when contemplating threatening situations like chronic illness or death. As our sample consisted of young, childless, mostly educated females in a developed society who are likely to wait a few more years before having their first child, it could be that the cues made them feel momentarily reproductively demotivated and inclined to wait for a better future situation in the real world, which they are likely to encounter given their relative privilege on a global and historical scale. Their responses might then be motivated by the desire to rear offspring in favourable circumstances. Moreover, the opportunity costs of childrearing for today's women, even compared to their own mothers, are unprecedented in human history if one lives in a rich nation with relative sexual equality. The women are probably aware that in this kind of society there are many diverting activities available alongside reproduction, and in the face of mortality cues they might be more inclined to compile a mental Bucket List than shop for babygros. Therefore it might not take much (a mere reminder of death or chronic illness; a mere reminder that one might have to set aside one's hobbies) to put someone off having children. In the experiment already described in Chapter Two, there is also a (non-significant) move by women faced with mortality cues towards anti-natalism, so this might be a replicable effect. Under Mortality Salience the men in the current experiment appear to have shown a similar (non-significant) drift to anti-natalism (apart from when judging a hypothetical woman), and it might be for similar reasons.

It might be, then, that life history theory offers more useful guidance for pre-demographic transition societies, where mortality and poverty are high, and also everyday life offers far fewer opportunities to pursue personal satisfaction as well as proxies for reproductive success such as social status. These opportunities are reduced for those of lower socioeconomic status even in developed societies, however, but in the current experiment the interactions with socioeconomic status found by Griskevicius et al. (2011), (whereby under Mortality Salience those who were at the highest levels of subjective childhood socioeconomic status showed less interest in having children earlier; and those at the lowest levels were more interested in having children earlier) were not replicated. This is despite the fact that the sample in the current experiment was arguably a little more socioeconomically varied than the previous authors' undergraduate sample. It would be useful to test the effects of Mortality and/or Morbidity Salience on different measures of pro-natalism on not only a truly varied sample within a developed society and/or a low-income country, as for now the notion that variation in life history strategy can be fully mapped onto socioeconomic differentials remains uncertain.

4.4.3 'Mechanistic' variables

Is it possible that any of the 'mechanistic' variables i.e. Subjective Life Expectancy, Subjective Disability-Free Life Expectancy, or the Positive And Negative Affect Scale provide any clues as to the pathways by which these results occurred? Looking at the only statistically significant results for the mechanistic variables, males were less alert in the Mortality Salience condition than in the control condition, an effect which is hard to make sense of substantively. In the Morbidity Salience condition, females were more afraid

than in the control condition, which might perhaps both reflect appreciation of the greater morbidity burden for their sex, and also underpin the (non-significant) tendencies discussed earlier i.e. being more anti-abortion (measured on the GAAS) and declaring a younger ideal age to have children while simultaneously being more approving (in a personal sense) of abortion, being less interested in imminent parenthood, and wanting fewer children. The 'mechanistic' variables also showed some non-significant trends: under Morbidity Salience both sexes expected to have a shorter disability-free lifespan; while Mortality Salience was actually associated with longer female expected lifespan than for controls, although males reported shorter SLE as a result of the manipulation. Looking at these results suggests that truncated perceived life expectancy was not the mechanism by which women came to display significantly higher (personal) abortion approval in this condition.

4.4.4 Use of abortion approval as a measure of reproductive motivation

Measuring abortion approval is a novel way of examining the effects of mortality (and/or morbidity) salience on reproductive motivation. In purely evolutionary terms it is *a priori* strange that people ever exhibit anti-abortion sentiment regarding the actions of other people as strictly speaking one should want reproductive rivals to have as few offspring as possible. Although previous research has found that Mortality Salience can increase the desire to have children, and incline people towards wanting more children, perhaps here where the dependent variable is abortion approval, people are thinking about the concrete choice regarding whether to continue to invest in an already extant pregnancy. Perhaps this elicits less idealistic responses than a focus on children *per se*. Abortion also has other connotations other than simple issues

of whether children are wanted. For men, whose attitudes to abortion are more negative even in the control condition, abortion might partly represent decisions about reproduction being taken out of their hands, as often such a choice is made unilaterally by a woman, and the female choice to have an abortion may be seen by a male as casting aspersions upon his suitability as a father, both materially and genetically. Men can also afford to be more idealistic and sentimental about childbearing and childrearing as they incur lower costs of obligate care. Therefore, even when males exhibit (non-significant) anti-natal responses under Mortality Salience, their score on the General Abortion Approval Scale actually (non-significantly) decreases. Someone does not need to want to have children in order to be anti-abortion. Particularly when abortion approval is measured with the GAAS, scores are relatively low. This may well reflect more 'moral' concerns regarding the ability to terminate the beginnings of a life, and it is easier to be moralistic about another person's choices than about one's own. Scores for General and Personal Abortion Approval do not always go in the same direction under the same treatment, looking at Table 4.7.

It is notable that although the results did not reach significance perhaps due to a small effect size, there is a trend towards pro-natalism when measured by the General Abortion Approval Scale for both sexes under Morbidity Salience, and for males under Mortality Salience. This is actually in line with hypotheses. There could be something about measuring abortion approval in this more abstract way which stimulates people's moral ideals entwined with pro-natalism. Silvers and Haidt (2008) discovered that when breastfeeding women watched a morally elevating video about a man paying tribute to his teacher who rescued

him from a life of violence (contrasted with a comedy video for controls), they lactated more, and hugged and nursed their children more. In the control conditions for both general and personal abortion approval, neither sex was especially approving of abortion. It could be that the additional moral component to abortion approval (e.g. the notion of 'taking a life'), especially when the question is framed in an impersonal way as in the GAAS, stimulates people's sense of the ideal world they would like to live in, and thus pro-natal responses. It might also be the case that Abortion Approval as a dependent variable has a moral dimension which asking people about their ideal number of children does not, as some people might have pre-conceived political or religious views about the acceptability of abortion which priming cannot change.

4.4.5 Early Parenthood Approval Scale and Ideal Age to Start Having Children

It could be argued that the Early Parenthood Approval Scale and the Ideal Age To Start Having Children variables actually also measure the same thing but in different ways. The former asks about the participant's interest in having children in the next few years, and the latter asks about the best age to begin. As we can see in Table Two, under Morbidity Saliency, the trend is for both sexes' responses to go in (non-significant) different directions, perhaps again highlighting the difference between personal desires and ideals. In Mortality Saliency for females the same thing occurs. But when males are exposed to Mortality Saliency, not only do they exhibit lower scores on the Early Parenthood Approval Scale, but they also favour an older age to start having children, both responses being anti-natal. Perhaps young males are aware of their greater likelihood of early death compared to females (Kruger & Nesse, 2006): perhaps they implicitly know that mortality risk for them reduces after

early adulthood, and wish to experience parenthood once these concerns are over. Ideal Number of Children has had some success as a dependent variable in the past as a measure of reproductive motivation (Mathews & Sear, 2008; Wisman & Goldenberg, 2005), but again, similarly to the current results, this might be because it taps into what people perceive as the best possible situation rather than something more realistic.

4.4.6 What have we learnt about Morbidity Saliency?

What do our experimental results have to say about the effect of morbidity saliency, which is arguably more pertinent in developed societies than in ancestral ones? Women are objectively more likely to experience morbidity than males, partly because they live longer than men (Case & Paxson, 2005; Oksuzyan, Juel, Vaupel, & Christensen, 2008). The PANAS results showed that females were significantly more afraid than controls in the Morbidity Saliency condition, but this did not translate into any significant reproduction-related results in the same condition. Looking at Table Two, apart from for the General Abortion Approval Scale already discussed, women had anti-natal responses to Morbidity Saliency, but these were not as strong as under Mortality Saliency. Thus, being reminded of morbidity actually seems to have put them off having children, but not as much as thinking about death did. Chronic illness is a more likely reality in their lives than is death, notwithstanding the fact that most participants are relatively well educated and thus unlikely to experience the worst ill-health in the population. Having a lowered Ideal Age to Start Having Children under Morbidity Saliency could be an acknowledgement of morbidity's encroaching likelihood with age. Gray, Evans and Reimondos (2013) find that for childless women a decline in health from fair to poor is associated with a

decrease in childbearing desires, as is an increase in age; so here participants behaved similarly, though contrary to the tenets of the 'weathering hypothesis'. The fact that these females in experimental circumstances behave differently to how proponents of this hypothesis might expect might be because as relatively educated and young women, they suspect that their lives may improve in the future, despite the temporary state induced by a psychological experiment. This would make them different to the women inspiring the weathering hypothesis (Geronimus, 1992, 1996b), who had considerably fewer life chances. It is known that education makes women less likely to have children (Basu, 2002). Again it remains to be seen whether further research on a less educated sample, or a sample from a developing country where life might not improve substantially in future, would yield different results.

Looking at how the males responded under Morbidity Salience, it was generally to become more pro-natal than controls, and this contrasted with their behaviour under Mortality Salience, where reproduction was largely off the cards. Perhaps from their point of view, chronic illness still offers the option of having children, especially if the burden of rearing children and of morbidity falls on the opposite sex.

Both sexes had overall more pro-natal responses to Morbidity Salience than to Mortality Salience. It could be that while Mortality Salience inclines people (at least in developed countries) to think that life is short and what remains of it could be used for something other than reproduction, Morbidity Salience might

allow people to retain ideas of having children, but focus on the associated quality of life (especially for women, as mentioned earlier). However, the ideal number of children for women under Morbidity Salience is lower than under Mortality Salience, even though both are lower than the control, which suggests a perception that morbidity might necessitate the need to mitigate reproductive load.

That said, Morbidity Salience did not actually elicit any statistically significant results, despite the fact that as described in Chapter Two, a geographical analysis of abortion in England and Wales found that higher levels of Long-Term Limiting Illness in a local area were associated with lower proportion of conceptions in abortion for under-25s. The discrepancy between these findings will be further explored in the Discussion in Chapter Five. Aside from issues of statistical power and small effect sizes, it could simply be that people are not especially attuned to cues of morbidity as chronic degenerative illness is a relatively recent development in history. Equally, morbidity does not offer the same immediate termination of the possibility of reproduction as death itself. In modern welfare states it is still possible to be chronically ill and bear children, thanks to well developed healthcare systems.

4.4.7 Limitations

The potential limitations of low power and an inadequately socioeconomically diverse sample have already been mentioned. A further issue might be the nature of the control condition. This was inspired in format (i.e. bogus quiz technique) by that used by Mathews and Sear (2008), due to ethical issues inherent to online psychology experiments whereby one cannot directly debrief

distressed participants if people are, for example, asked to think about their own death. In terms of content (lost property), the control mimicked that used by (Griskevicius et al. (2011)) in its aim of using a neutral subject matter. It could be that the control itself had perverse effects on participants' responses, which cannot be known. Nevertheless, the PANAS results did not indicate any statistically significant emotional responses in the control condition.

4.4.8 Conclusion

In summary, the experiment showed that, contrary to the hypotheses generated by life history theory, mortality salience elicited from female participants a self-reported inclination to be more likely to have an abortion compared to controls, were they to find out today that they were pregnant. This is in contradiction to the pro-natalist effects reported in much of the mortality salience literature, and might be because, in framing the main response variables as abortion approval, the experiment gave rise to a more highly charged appraisal of the appeal of imminent parenthood. Morbidity Salience had no significant effects. More research should be done with novel measures of reproductive motivation, such as abortion approval; likelihood of using contraception, etc. in order to investigate similarities and dissociations between different measures. It is only via replication that we can be sure that previous findings regarding Mortality Salience actually indicate genuine effects, and we urge caution in acceptance of the Mortality Salience results as they were not found in our previous experiment in Chapter Three.

Chapter 5 Discussion

5.1 What do the results mean as a whole?

If we take the results of the geographical analysis and the two experiments together at face value what do they appear to tell us about how far elevated morbidity and/or mortality in England and Wales play a role in people's propensity to be pro-natal in the form of rejecting abortion, behaviourally or attitudinally? The geographical analysis indicated that broadly speaking, in the under-25 age band, the higher mortality or morbidity in the local ward, the lower the abortion proportion in that area, all else equal. However, in the over-25s, higher mortality and morbidity in an area was associated with more conceptions ending in abortion, with one exception: for those 35 and over, local morbidity was not significantly related to abortion proportion. The results of the first experiment showed that being asked to think about a long, healthy life (Longevity Salience) made 18-25-year-old women significantly less approving of abortion (measured via the 'acceptability' of a hypothetical woman's reasons for abortion), contrary to our predictions. The same stimulus did not affect participants' stated interest in becoming a parent in the next few years, however. Mortality Salience affected none of the dependent measures for either sex, also contrary to predictions, despite the fact that male Subjective Life Expectancy was shorter than for controls in this condition. The second experiment showed an effect of Mortality Salience for women this time: it made them more in favour of abortion (this time when asked if they would have an abortion if they discovered they were pregnant now), again counter to predictions. Morbidity Salience had no effect on women, despite the fact that they were more afraid than controls in this condition according to the Positive And Negative Affect Scale (PANAS). Men showed no significant response to

either prime. Subjective Life Expectancy and Subjective Disability-Free Life Expectancy for both sexes were unaffected by the primes. Inexplicably, men were less alert than controls according to the PANAS responses.

What these results appear to mean *a priori* if we take them as a whole is that although at an aggregate level greater morbidity and mortality are related to reduced abortion proportion in women 25 and under just as life history theory would predict, there is no evidence that at an individual level morbidity or mortality perception are the specific causal factors in this pro-natalism. Indeed, women's responses to Mortality Salience (Experiment Two) and Longevity Salience (Experiment One) actually went in the opposite direction to that which was expected; Morbidity Salience did not affect either sex significantly; and males had no significant response at all to any of the primes. The primes also did not appear to affect Subjective Life Expectancy or Subjective Disability-Free Life Expectancy as we would expect, other than Mortality Salience decreasing male SLE in Experiment One, and this suggests that there is not a clear pathway from these longevity, mortality and morbidity cues, via a sense of (healthy) life being longer or shorter, to outcomes of reproductive motivation. It is also quite possibly the case that the primes did not work as they were intended to, and in fact did not induce the requisite thoughts of death, illness or long life that they were intended to. Therefore, the oft-found aggregate-level negative relationship between deprivation and abortion in young women does not appear to be mediated by local mortality or morbidity cues experienced by individuals, that is if the primes used in the experiment are operating correctly.

5.2 Another possible mediator between deprivation and abortion

As the main relationship appears to be robust, it must be that a different aspect or aspects of deprivation are more important factors in the relationship. A good candidate is education, or its lack. Looking back at Tables 2.3 and 2.5 in Chapter Two's geographical analysis, education (proportion of population aged 16-74 with Level 4/5 qualifications) has a larger coefficient than either life expectancy (mortality) or age-standardised long-term limiting illness prevalence (which is measured using the same proportion/prevalence units as education), and the direction of effect is as we might expect. The education variable also can be seen to exhibit the same 'age flip' as mortality/morbidity, only this occurs between the 25-29 and 30-34 age bands, later than for the health variables. We can see from Conrad (2012), summarised in Table 1.1 in Chapter One that the negative relationship between deprivation and abortion in English local authorities decreased in size from 1998 ($r = -0.501$) to 2010 ($r = -0.332$), a statistically significant change. Certainly one thing which has changed in UK society over those years is the emphasis on education as a route to success in an ever more competitive and unequal society increasingly based on service industry and a knowledge economy. Between 1998-9 and 2011-2, higher education participation in England among young people has increased from 30% to 38%, and the female participation rate has increased more for women than men. Even in the most disadvantaged areas the participation rate has seen a proportional increase of 16% (HEFCE, 2013). Reviewed in Table 1.1, Uren et al. (2007) found that London wards were exceptions to the inverse relationship between deprivation and abortion; and certainly since 2000, even schools in deprived London areas have gone from being the worst performing in the country to among the best (thinktankreview.co.uk, 2015).

As Hillard Kaplan, Lancaster, and Robson (2003) argue, as societies modernise there are increased payoffs to education (which helps to form embodied capital) and decreased mortality which then tend to promote increased investment in education and in staying alive. The trade-off here is crucially between accumulation of embodied capital and reproduction, not only in the form of time taken to get qualifications versus time taken to bear and rear children; but also between investing in offspring's education (investing in quality) versus having more children (quantity) (H. S. Kaplan & Gangestad, 2005). While it is possibly the case that perceived elevated mortality/morbidity likelihood in themselves might be the drivers behind reduced education uptake and concomitant earlier reproduction, to date there are far more epidemiological studies investigating possible causal effects of education on health (Arendt, 2005; Cutler & Lleras-Muney, 2006; Silles, 2009), rather than the other way round. Geronimus et al. (1999), writing about the 'weathering hypothesis', cite them as equally probable causal factors in early fertility. It also may be far easier for individuals to correctly perceive changed social norms encouraging education (e.g. government initiatives; pushy parents; competitive classmates) than changed local prevalence of mortality or morbidity (Montgomery, 2000).

In many of the qualitative analyses previously done on deprivation's relationship to abortion (summarised in Table 1.3) there are clear differences between the most and least advantaged groups regarding how much emphasis is put on education, career and money versus childbearing. It is possible also that we are prey to psychological mechanisms adapted to maximise material wealth, increasingly seen as the goal of modern education, but this then leads to a much lower fertility level (Mulder, 1998). A 2013 report (Crawford, Cribb, & Kelly,

2013) linked the likelihood of a teenage pregnancy continuing to motherhood to individual characteristics such as free school meals eligibility; persistent absence from school; low prior educational attainment; deterioration in academic performance between ages 11 and 14; and attendance at a lower performing school.

5.3 Individual-level factors in reproductive motivation

What then have we learnt from the two experiments in Chapters Three and Four (Experiment One and Two respectively) about individual-level factors which do appear to affect reproductive motivation? And how do their results compare with the already existing experimental research, summarised in Table 1.4?

5.3.1 Effects of Mortality Salience

Firstly, both experiments investigated possible effects of Mortality Salience, which invites the possibility of replication and more robust knowledge regarding effects. In the second experiment, in Chapter Four, the only statistically significant result was that women under Mortality Salience became more approving of abortion on the Female Personal Abortion Approval Scale which asks them if they would have an abortion if they discovered they were currently pregnant and which ranges from +3 “Definitely yes” to -3 “Definitely no”. This suggests that thinking of death makes women less interested in reproduction, possibly because young women in modern developed societies expect, and are likely to get, a better life situation before they reproduce. This anti-natal effect under Mortality Salience may have been echoed in Experiment One in Chapter Three, where there is a non-significant trend towards the same anti-natal effect on the same variable. However, as the sample size for Experiment One was

actually larger than for Experiment Two, we would expect there to be a larger effect size, so actually this result seems to show that there is no genuine replicable effect. All we can do is say that within the Experiment Two sample Mortality Salience gave rise to this anti-natal effect, but this appears not to be generalizable to a wider population.

5.3.2 Comparisons with previous experimental research

Although the significant results do contradict our hypotheses, they do echo some previous experimental research showing that Mortality Salience either only appears to lead to pro-natal results in women after they have been reassured that there will be no conflict with career, and otherwise women are anti-natal under Mortality Salience (Wisman & Goldenberg, 2005). Such results remind us of the additional cost of childbearing for women and an associated ambivalence about it, which might be triggered by even small hints of hardship. Educated women in modern developed societies might tend towards wanting ideal circumstances for raising children, being willing to wait longer for those circumstances until it becomes for some women too late to have children at all.

There were a couple of instances where the non-significant trends under Mortality Salience were in the same direction across both experiments, perhaps hinting at a genuine (though very small) effect: there is a similar (non-significant) drift towards anti-natalism for women on the Early Parenthood Approval Scale, again echoing the Wisman and Goldenberg (2005) results; and for men there is a non-significant trend towards more pro-natalism on the General Abortion Approval Scale in each case. Here men are judging a hypothetical woman's actions and it might be that it is easier for them to consistently uphold pro-

natalism for this variable where the scenario does not demand that they think about their own relationship to (unborn) children. There is no previous research to tell us how priming usually affects abortion attitudes, but we do know from our own data that men are slightly more anti-abortion than women to start with. As these results are non-significant it would take more research with a much bigger sample size to see if these trends would ever show up as genuine effects. Other trends under Mortality Salience did not head in the same direction across the two experiments.

Mortality Salience in Experiment Two (described in Chapter Three) was also investigated using two new variables that were not used in the first experiment: Ideal Number of Children and Ideal Age to Start Having Children. Neither of these saw any significant treatment effects for either sex. In previous research (Mathews & Sear, 2008; Wisman & Goldenberg, 2005) Ideal Number of Children increased under Mortality Salience (at least for men), but that was not replicated here, with it actually trending in an anti-natal direction, suggesting the effect found previously might not be reliable. Ideal Age To Start Having Children trended towards younger for women and older for men with the same prime, but it is hard to know what to make of these findings.

5.3.3 Effects of Longevity Salience

Moving on to investigations unique to each experiment, in Experiment One the significant effect of Longevity Salience on women was to make them more pro-natal, contrary to expectations. If this effect were replicable, it might mean that there is something about considering a long, healthy life which inspires women to become more interested in having children, already discussed in Chapter Three. It might be that women are more responsive to the notion of longevity

than are men (who saw no effects of Longevity Salience), simply because they are more likely to experience it (Case & Paxson, 2005).

5.3.4 Effects of Morbidity Salience

In the second experiment, described in Chapter Four, Morbidity Salience was primed and there were no significant effects for either sex. It is possible that the patterning in non-significant trends here, already discussed in Section 4.4.1, with men generally becoming more pro-natal and women becoming less, might indicate genuine effects, but again, a larger sample size would be needed to detect anything not already picked up.

As Longevity Salience and Morbidity Salience have not been used in previous priming experiments there is no previous research with which to compare them.

5.3.5 Interactions with socioeconomic status and comparison with previous research

We did not find the same interactions with socioeconomic status discovered by Griskevicius et al. (2011). Theirs occurred at one standard deviation above/below the mean of subjective childhood socioeconomic status, with participants expressing less/more interest in imminent parenthood respectively when they were primed with Mortality Salience. They wrote that this was an example of faster life history strategy being related to having grown up relatively poor, and slower life history strategy being related to having grown up relatively wealthy, tendencies which were then triggered by reminders of death. The only interaction we found with subjective childhood socioeconomic status was that in the first experiment, men under Longevity Salience were far more approving of early parenthood if they were in the top decile of SES. As theoretically and

conceptually speaking, we expected the main effect of Longevity Salience to be decreased interest in imminent parenthood, and following Griskevicius et al. (2011) we would expect higher socioeconomic status to also be related to decreased interest, our results go completely against those of the previous researchers and against our own theoretical predictions. In our data, socioeconomic status does not appear to moderate life history strategy in the same way that they have described, and this might mean that their result is not reliable. In our sample it is somewhat interesting that those men at the highest level of subjective childhood socioeconomic status had such high scores on the Early Parenthood Approval Scale when primed with Longevity Salience. Could it be that these young men were triggered by the longevity cue to feel that circumstances were good, and that due to their well-provisioned childhoods (and possibly continuing financial support from family) they could entertain the thought of having children fairly soon? Perhaps this is a similar finding qualitatively speaking to women's lowered General Abortion Approval under Longevity Salience and their non-significant trend towards lowered Personal Abortion Approval in response to the same cue.

5.3.6 Comparing geographical analysis to previous geographical research

How are the results of Chapter Two's geographical analysis of morbidity and mortality's relationship to 'abortion proportion' similar or different to previous similar research? Most previous multivariate geographical research in England and Wales (summarised in Table 1.2) has not investigated how health deprivation relates to abortion proportion, although other types of deprivation, like percentage of 11-15-year-olds dependent on Family Credit claimants; percentage of the economically inactive population unemployed; percentage of

17-year-olds not in full-time education have all been linked to a lower AP (Lee et al., 2004).

The only multivariate study that did use health measures within England (Bradshaw et al., 2005) discovered that higher local authority-level 'health deprivation and disability' meant a lower AP for the 15-17-year-olds in their sample, and this was the case in their final model for both time periods (1994-6 and 1997-9). Our findings were the same, at least for the under-25 age band. Interestingly, education, skills and training deprivation did not make it into their final models. Bradshaw et al. (2005) did not investigate older age bands in their work, unlike our study. The Canadian study by Krupp (2012) showed that life expectancy had a positive relationship to abortion rate (number of abortions/1000 same-aged females) at two jurisdictional levels, controlling for income. He found this to be the case across the two age bands which he used: under-15s and over 40s. This is not the same as our findings: although life expectancy had a positive relationship to abortion proportion, all else equal, in our under-25 age band, it had a negative relationship with it in our 35 and over age band (the nearest comparable age band to over-40s). It could be the case that there is something about the over-40s which makes them different from the 35 and over group in our data. Perhaps the Canadian women in his sample in regions with longer life expectancy were limiting family size using abortion from the age of 40 onwards. This probably means that because our final age band also includes women aged between 35 and 40, it captures a number of women in places of higher life expectancy who are having their first child(ren) in their late thirties, perhaps after a long period of education and career. If the

Canadian data used by Krupp had included those aged 35-40, the same negative relationship with Life Expectancy might have been seen.

Hence our research does seem to echo existing geographical studies which do find that poor health or a lower life expectancy in a locality make abortion less likely for the youngest women. Our data were, however, able to demonstrate that above the age of 25, the same poorer health in a ward is related to higher abortion. The only exception was for the 35 and over age band, where there was no relationship between abortion and morbidity, but there was one between abortion and mortality. As long-term limiting illness prevalence comes from a self-report measure taken from the Census where people are asked if they have a long-standing illness which limits their daily activities, it could be that it lacks the accuracy of the mortality measure. Self-report measures have been criticised before now because it is not only unclear whether individuals have the same subjective cut-off points for deciding they have an illness and/or its severity; but also because in areas of health disadvantage people could be comparing themselves to similarly disadvantaged people and are therefore unable to tell how unhealthy they truly are (Prince et al., 2008; Salomon, Tandon, & Murray, 2004), but this does not necessarily explain the dwindling relationship between morbidity and AP for this age band. The lack of relationship for morbidity may well be related to increased concern among women of that age regarding the health of their foetuses, as congenital abnormalities increase at the end of the reproductive lifespan; and family size limitation may be a strong factor also at this age.

5.3.7 Limitations to the research

There were inevitably some limitations to the research contained within this thesis. For the experiments, recruiting a truly socioeconomically varied sample proved challenging and was not truly achieved, despite the use of online recruitment rather than the use of undergraduates. This is a difficulty faced in a number of the previous experiments, including that done by Taubman–Ben-Ari and Katz–Ben-Ami (2008) where the sample was from the general population, but actually comprised many highly educated women. Unfortunately, although online samples are slightly less homogeneous than undergraduate samples, they still tend to be quite highly educated. On Crowdfunder, the survey site which helped us recruit our sample, 32.4% of their British contributors who are allowed to take part in surveys have at least a Bachelor’s degree; and a further 8.4% have a Masters or a Doctorate, according to their statistics compiler (Statwing). It is difficult to further compare US educational levels between those given on the Crowdfunder site to our British samples, which had a further 30-40% with A-levels, suggesting that they were on the road to higher education and the fertility postponement and reduction which that can involve. According to the Crowdfunder site, their British contributors also mostly come from low to middle income backgrounds rather than the very lowest. It may be that in recruiting 18-25-year-olds, we disproportionately drew from a student sample. Crowdfunder only allows people who have performed well on other jobs available on their site to actually take part in surveys, since with the latter there are no right or wrong answers so quality control is harder to guarantee. This means the recruitment method is far from a random sample, and therefore generalisability is very limited. Nonetheless, the sample was probably more varied than that used by Griskevicius et al. (2011), but despite this we did not

find the interactions with socioeconomic status that they did in their undergraduate sample.

Another issue with recruitment is payment. In economics studies, this is routine, but in psychology the norm tends to be for participants to take part for academic course credit. As London School of Hygiene & Tropical Medicine does not have a psychology department, this was another factor mitigating against the use of undergraduates. Crowdfunder was far and away the most successful recruitment method we experimented with, among several methods including Facebook advertising; emails routed to students via academic staff at universities; and dedicated websites such as Call for Participants. However, Crowdfunder asks for participants to be paid a nominal sum for participation, and in several cases this inspired some participants to take part in the same questionnaire twice, which then necessitated removal of their data, shrinking the sample size very slightly.

Creating cues and control conditions was also very challenging for the experiments. As they were follow-ups to mortality salience research specifically using life history theory, the cues used in them were inspired by those used by researchers finding pro-natal results using the same theoretical framework (Griskevicius et al., 2011; Mathews & Sear, 2008). Attempts were made to compose a bogus news story about a rise in random killings for the Mortality Salience prime similar to that used by Griskevicius et al. (2011), but adapted especially for use with British participants, so that the specific feelings of uncontrollable extrinsic mortality would be evoked, rather than asking participants to describe the emotions and physical process of dying used by proponents of Terror Management Theory. Vidas Griskevicius was contacted

via email regarding the control stimulus he had used, which is described in their research paper as 'a similarly formatted article on a man losing his keys and looking around the house for them'. On reading the control stimulus they had used, it became apparent that it was not formatted like a newspaper article, and was instead an account written in the second person (e.g. "You find some pieces of paper, but no keys. Feeling angrier, you go into your closet and start throwing things to the floor. No keys."). This was of concern, as ideally controls should resemble the experimental stimulus as far as possible, but be different only in the aspect which is being tested, in this case, reminders of mortality. Therefore it was decided to use a bogus quiz format like the mortality salience prime used by evolutionary researchers Mathews and Sear (2008) (although with no stimulus in the control condition), and in the control condition to have another bogus quiz. Lost Property was chosen as the control quiz topic because it resembled the topic of the control used by Griskevicius et al. (2011); and then similar quizzes were created to deal with Morbidity and Longevity Salience primes.

In hindsight it would have been a good idea to pre-test the stimuli, as did the previous researchers, on a different sample to make sure that they were all equally emotionally arousing; and to make sure that they differed in terms of the messages they were sending e.g. the longevity prime alone should elicit ideas of there being plenty of time and no threat; the morbidity prime alone should give a sense that chronic illness (not death) is something one should be concerned about. It is interesting to note, however, that Griskevicius et al. (2011) in two further studies within the same paper appear to discard the 'lost keys' control in favour of no stimulus at all. Wisman and Goldenberg (2005)

appear to, across their studies, use not only an aversive 'describe a trip to the dentist' control condition, but also a 'describe watching television' control, with the same results, which would appear to hint that the specific details of the control condition might not be important. Clearly other researchers find creating control conditions for psychology experiments a very inexact science too. In our Experiment Two, men were significantly less alert (according to the Positive And Negative Affect Scale) in the control condition, so it is possible that the tedium of a quiz about lost property statistics and emotions which would never occur in real life might have actually bored them, which is not ideal, and makes the baseline of emotion that one is hoping to create quite unclear.

It is difficult to know whether the primes actually used for the research described herein were actually stimulating the feelings that we wanted them to. This is partly why the 'mechanistic' variables were used (Subjective Life Expectancy; Subjective Disability-Free Life Expectancy; Positive And Negative Affect Scale) to act as manipulation checks. In the first experiment, male SLE was significantly reduced in the Mortality Salience condition, and women responded similarly, though to a non-significant extent. Women appear also to have responded to Longevity Salience with longer SLE, though not significantly, but men actually had shorter SLE than controls in the same condition. Therefore it is arguable that Longevity Salience did not stimulate the sense of a lengthened lifespan in men, but it is unknown what feelings it did stimulate instead. In the second experiment Morbidity Salience did elicit a shorter Subjective Disability-Free Life Expectancy for both sexes (though not significantly), which is reassuring, but SLE only went in the expected direction for men, not women under Mortality Salience. Although much of the time the

manipulations seem to have sent these measures in at least the expected direction, there is a decoupling between significant effects on these mechanistic variables and significant effects on the reproduction-related dependent variables. And in Experiment Two, women giving a longer SLE under Mortality Salience was then paired with them being more disapproving of abortion in the same condition, which means again that it is not clear what the women are responding to in the primes. Although they were more afraid on the PANAS in the Morbidity Salience condition, there is no significant related effect on the reproduction-related variables.

Looking back at the primes (included in Appendices C and D), it is possible to speculate that the Longevity Salience condition in particular might have had perverse effects by stimulating unforeseen emotions. Although in writing it we attempted to emphasise a long lifespan, there are contained within many reminders of exercise, retirement, friendship with someone older, pastimes in old age. It is quite probable that these cues were actually making people think of old age, which is anathema to life and excitement for our young sample, especially the males. Living a long life is very far from the thoughts of those as young as our sample. By the time thoughts of a long lifespan become comforting, people might be into their forties, and actually not in a position to start reproducing.

The failure of the significant result in Experiment Two (women becoming more approving of abortion under Mortality Salience) to be significantly replicated in Experiment One (despite a larger sample size in the latter) also brings to mind the recent findings of the Reproducibility Project about the lack of replicability in many well known psychology experiments, especially those involving priming

(Baker, 2015). While psychology might not be the only field with this problem (Begley & Ellis, 2012), the discovery is sobering. Certainly the experimental results contained herein do not replicate the effects shown in previous research, and they also do not replicate each other. This lack of reliability could be partly to do with the complexity of the phenomena under study, and the difficulties, outlined above, of creating rigorous procedures and stimuli in the study of human behaviour. But an even more problematic reason could be that non-replicated results are hidden away in file drawers or subject to publication bias of significant results. Therefore it is not easy to know if here we have failed to replicate a genuine phenomenon (pro-natalism under Mortality Salience) due to methodological problems or whether the phenomenon does not actually exist to begin with. Due to confirmation bias, people (including scientists) are often more likely to believe in published research which supports their pet hypotheses, and this is once more cautioning against that.

Sample size for the experiments was also partly at the mercy of what could actually be achieved and available funding for remuneration of participants. Although neither experiment got results in line with hypotheses, it is not necessarily the case that with a bigger sample they would have done so, as the pattern of significant and non-significant findings clearly show in the emerging results, where effect sizes are clearly biggest for unpredicted effects.

The geographical analysis also has limitations, but these were more in the nature of the data available (aggregate, with the risk of ecological fallacy), already discussed in Chapter Two, rather than with the specific analysis used. It would have been ideal in some ways to actually have a composite measure of measure of deprivation, such as the Indices of Multiple Deprivation (IMD), which could

then be disaggregated into different subscores related to health and life expectancy to actually do a formal causal mediation analysis of whether the effect of deprivation on abortion proportion was specifically or partially mediated by mortality/morbidity. Unfortunately the IMD do not contain any measures of Life Expectancy, and so it was decided instead to build the entire dataset around the experimental life expectancy figures provided by the ONS and collate other measures for the same approximate time period (1999-2003). Additionally, with the dependent variable (abortion proportion) being impossible to model as a linear or binomial variable, on the advice of a statistician here at London School of Hygiene & Tropical Medicine it was decided to abandon a mediation analysis and work with a more conventional regression analysis. It is hoped that the small population size of wards does something to lessen the problem of ecological fallacy as advised by Lancaster et al. (2006).

5.3.8 Contributions to existing research

Nevertheless, despite these limitations, the research contained in this thesis has made some novel contributions to the field. It has replicated results from a geographical study on health deprivation and abortion proportion (Bradshaw et al., 2005), showing that the youngest women are less likely to have abortions in areas where health is poor. Additionally it has shown, to our knowledge for the first time, that this relationship with ill-health appears to be an age-specific phenomenon, and under similar conditions, all else equal, women over 25 in England and Wales appear to be more likely to have abortions. However, the research has challenged assumptions derived from life history theory that this relationship occurs via cues of mortality and/or morbidity being perceived in

some way by individual women, as in our experiments, morbidity and mortality cues did not elicit pro-natal effects, that is, if we assume that the primes had the expected effects. This then calls into question the nature of the association seen in observational studies between mortality/morbidity and abortion, and suggests that other pathways, such as via educational uptake, might be much more important. In disaggregating different elements of socioeconomic status for our observational analysis we have been able to say more than 'more deprived people have children sooner'.

This research has also used abortion approval as a novel dependent variable to examine reproductive motivation and has at the very least shown us that the results that one gets depend, unsurprisingly, on how something is measured. We see dissociations between levels of abortion approval depending on whether it is measured via judgements of a third party, or whether someone is asked whether they would have an abortion now. We see further dissociations between people's Ideal Age To Start Having Children and their responses on an Early Parenthood Approval Scale on whether they would like to have children in the next few years. Researchers continuing to study reproductive motivation should be aware of these inconsistencies.

Our work also suggests that thinking about old age might actually make women more pro-natal; and also that Mortality Salience might make them less so, both against predictions. This might tell us something about the nature of reproductive motivation among relatively educated people in developed societies, suggesting that hints of poor circumstances might actually make people less interested in having children if they think that a situation might improve later.

We have also investigated the effects of Morbidity Salience on reproductive motivation, which is also novel in the discipline to our knowledge. It had no significant effects on either sex, but other researchers should continue to investigate, perhaps in more ecologically valid ways, whether subjective or objective morbidity does have an effect on reproductive motivation as one would expect.

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Chapter 6: Appendices

6.1 Appendix A: NESCent Psychological Mechanisms of Fertility Behaviour Literature Review

WORKING GROUP

Integrating Evolutionary Models of Human Fertility Change

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Project: Psychological Mechanisms of Fertility Behaviour

Stage 1: Literature Review

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Goal: Review existing literature for research that addresses psychological mechanisms associated with fertility desires, attitudes, plans, behaviours and outcomes that utilizes experimental methods.

INTRODUCTION

The literature on psychological mechanisms is vast, as we have begun to document in the Excel file “NESCent PMFB Literature Review: Reading List”. However, research utilising experimental methods is extremely limited, as documented by the significantly smaller Excel file “NESCent PMFB Literature Review: Annotated Bibliography”. We consider experimental methods to be research in which independent variables (thought to be causal factors) are systematically manipulated using controlled observations in order to measure their effect, in this case on reproductive motivation or related outcomes. Below we state our review procedure and argue for experimental methods in the social sciences. This is followed by a summary of the experimental methods used in the literature reviewed in the Excel worksheet “Annotated

Bibliography” and other methods that may be applicable. We finish with brief summaries of the main research topics/clusters we found in the literature, and had time to address.

REVIEW PROCEDURE

For this literature review Google Drive and Dropbox were used to organize, share, and build a Reading List with associated PDFs for each article, an Annotated Bibliography, and this summarizing document. Before the literature review began, LM and SV designed the Reading List template, and using Google Forms LM created an online form for entering readings into the Annotated Bibliography. The form was designed to increase consistency across time and between readers in what information was entered, and latter searchability. It also allowed multiple workers to simultaneously enter information into the Reading List and Annotated Bibliography. This meant there was only one working copy of each file. In case of corruption or accidental deletion LM made twice weekly copies of the Reading List and Annotated Bibliography in Microsoft Excel.

Literature was discovered using a systematic three-step search process.

Step 1

The following databases were searched: Google Scholar; PsychInfo, PubMed, Web of Science

The original search terms used are shown below. All connotations and tenses of the words were tried.

- **Primary terms** – baby fever, childbearing, childlessness, contraceptive use, cooperative breeding, family planning, father absence, fertility, fertility desires, fertility intentions, fertility motivation, kin, mate, morbidity, mortality, nurturing, offspring, parental investment, parenthood, parenting, reproduction, reproductive autonomy, reproductive decision making, reproductive timing, sex ratios, sexual coercion, value of children
- **Secondary terms for methodology** (always in conjunction with a primary term) – experimental methods, laboratory, memory essays, priming, psychological mechanisms, vignettes, word association, word completion tasks.
- **Secondary terms for theory** – Attachment Fertility Theory, Attachment Style, Life History Theory, Motivation, Religion, Terror Management, Theory of Planned Behavior, Traits-Desires-Intention-Behaviors, Transmission Competition Hypothesis.

The abstracts of all articles found were reviewed for relevance and if the abstract left the relevance unclear the paper was skimmed. All relevant papers were added to the Reading List. Over 200 journal articles, books, book chapters, theses and working papers were added to the Reading List. Papers believed to use experimental methods were noted. Less than 10% of the initial Reading List was found to explicitly use experimental methods. Most papers simply suggested it would be valuable for future research and/or spoke about proposed psychological mechanisms.

Step 2

Papers that used methodology of interest were read in detail, added to the Annotated Bibliography, and aggressively mined for additional references and associated papers. Any reference from an initial article that appeared relevant was researched and located. If relevant it was added to the proposed list of reading. In addition, if a paper was considered to be extremely relevant the authors were contacted, all work by the lead author quickly reviewed for relevance, and current research agenda of author(s) investigated. Papers that were purely theoretical in relevance are included to help frame questions and ideas. They will likely be important if a literature review is written and for grants. Papers are clustered by topic with several key papers from each topic reviewed in detail and summarized in Topic/Cluster Summaries.

Step 3

Google scholar was used to find articles that cited any highly relevant articles. These citing articles were considered for addition to the reading list.

Using the above procedure 26 articles were found (10.61% of the reading list) that used experimental methods and at least touched on topics related to reproduction, if not directly addressing it. The Annotated Bibliography contains an additional 43 articles due to their theoretical relevance.

ARGUMENTS FOR EXPERIMENTAL METHODS

There is an increasing call for the use of experimental methods in the social sciences (Falk and Heckman, 2009; Jackson and Cox, 2013; Cesario, 2014). Experimental methods are used to separate out causal factors by running an experiment many times with only one variant. If the results change with the variant then that variant is likely the cause. In chemistry, physics and biology it is relatively easy to create situations where all possible casual factors can be controlled and replicate them multiple times. Concerns about the use of experimental methods to study human behavior, given its complexity, and the validity of taking experimental methods to field settings, where it is harder to control variables, have been points of interest in statistical theory for decades. Thus, experimental design in settings with irregular and non-predictable variation (i.e. naturalistic settings with humans) has been increasingly addressed and supported by statistical theory and application (Jackson and Cox, 2013). There are four main principles of experimental design in the presence of substantial uncontrolled variation: (1) elimination of systematic errors; (2) enhanced precision by comparing like with like; (3) replication; and (4) factorial design so that multiple questions can be addressed in one experiment (Fisher, 1935 (in: Jackson and Cox, 2013)). For excellent walkthroughs of experimental methods for the social sciences, discussions of the advantages and disadvantages of experimental methods, and direct comparisons with more traditional social science methods (e.g. surveys and observation in naturalistic settings) see Falk and Heckman (2009), and Jackson and Cox (2013).

Economics research has utilized experimental methods since the 1940s, though from 2000 to 2008 only <4.15% of published papers utilized laboratory experimental methods (Falk and Heckman, 2009). Political science and some subdisciplines of psychology were also early adopters of experimental

methods, but in general uptake has been slow, resisted and critiqued among most of the social sciences. The resistance to experimental methods stems from beliefs that they, especially laboratory based experiments, lack realism, generalizability and replicability, compared to traditional methods (Falk and Heckman, 2009; Jackson and Cox, 2013; Cesario, 2014).

The issue of low realism in experimental methods, especially lab based, may be mooted by the issue of isolating causal effects. Traditional field methods can only isolate causal effects when the relationships are linear, which may be rare. However, experimental methods provide controlled variation allowing for control of decision environments in a way that is hard to duplicate in naturalistic settings (Falk and Heckman, 2009). Experimental methods can also provide high internal validity, especially in laboratory settings (Jackson and Cox, 2013). However, experimental methods have potentially low external validity compared to traditional field methods. Taking experimental methods to field settings should provide high external validity providing cultural and educational differences are addressed, and reduce critiques regarding realism and generalizability of findings. For example, field experiments with factorial designs, that have vignettes embedded alongside standard survey instruments, have proven quite successful (e.g. Kushnick, 2013).

Field experiments encourage movement to new populations and environments, which can lend additional insight. While experimental methods research is often based within university populations that arguably are WEIRD (Henrich et al, 2010) and have limited experience with many of the behaviours of interest. There are increasingly examples of experimental methods being used with non-University populations (e.g. Auspurg et al, 2013; Eurich, 2012; Little et al, 2007; Zhou et al, 2009), populations with specific and relevant experience (e.g. Taubman and Katz, 2008; van der Wal et al, 2013), and with developing populations and in more traditional field settings (e.g. Kushnick, 2013; Newson et al, 2007). Also, focusing on university populations is valid if assuming human universals and if predictions are independent of assumptions concerning the subject pool.

The issue of replication, as it refers to experimental methods within the social sciences, has two points. First, a requisite of experimental methods is controlled repetition within the same study; and second, critics of experimental methods in the social sciences harp on instances where published research could not be replicated in different populations or at different times. Cesario (2014) addresses the need for internal repetition before publication. Having repetitions built in to the original research is important when claiming the use of experimental methods and Cesario (2014) makes some suggestions about how to do this given the risk of participant fatigue. Cesario (2014) also discusses not expecting high replicability across different populations and times. Low external replicability should be expected as it is extremely difficult to control all affecting factors when studying human behaviour.

SUMMARY OF EXPERIMENTAL METHODS

The experimental methods found in the literature reviewed here, and in the Annotated Bibliography, consist of largely factorial designs utilizing either hypothetical vignettes that respondents suggest what they would do under those circumstances, or priming. The vignette designs likely access mostly conscious decision making, as respondents must state a clear opinion on the vignette (e.g. Newson et al, 2007; Kushnick, 2013). The primed experiments have the advantage of getting at both conscious and unconscious decision making processes providing the dependent measures are appropriate.

VIGNETTES

Vignettes were often embedded in a larger traditional survey, and were used in online or computer based surveys and in-person interviews with university populations (Straits, 1985; Woolf and Maisto, 2008), the general public in developed and developing countries (Newson et al, 2007), and with traditional populations (Kushnick, 2013). Kushnick (2013) gives a good defense of using vignettes in work with traditional populations and cross-culturally. A vignette is a short carefully crafted scenario of a person, object or situation used to elicit people's beliefs, attitudes, judgments, knowledge or intended behavior with respect to the presented scenario. Factorial design allows for the estimation of the effects of multiple factors and their interactions. When combined vignettes and factorial designs allow for subjects to be presented with combinations of characteristics not actually available in the population. This means that as a proxy you can see what others in the population expect people to do under that scenario. This is common in anthropological studies with small-scale societies. Vignette studies are also well suited to testing hypotheses cross-culturally and have been shown to be predictive of actual behavior (suggesting ecological validity). However, links to psychological mechanisms and/or reproductive behavior are few in the existing literature.

In the literature reviewed here, researchers used vignettes to address how various factors influence maternal care (Kushnick, 2013), women's fertility aspirations (Straits, 1985), how power within a relationship affects contraceptive use (Woolf and Maisto, 2008), and how maternal kin and peers vary in their preferences for hypothetical women's reproductive behavior. Respondents usually read several vignettes with a 2X3 or 2X2 factorial design and stated their opinion on each vignette. For example, Straits (1985) explores the influence of direct costs, indirect costs and cultural support on US college women's fertility aspirations. This is assessed through the response of 180 undergraduate women to six vignettes of hypothetical decision making situations. Each vignette had two to three versions with each woman seeing only one version. There were 25-30 women per cell of the vignette version. In the vignettes things like familial wealth and current parity, or status of wife's job promotion and parity were manipulated. Straits (1985) found, using these vignettes, that US undergraduate women favored career over reproduction if parity was zero, but as parity increased women's careers were increasingly disfavored, though this depended on the kind of career advancement available to the hypothetical woman. Also, US undergraduate women favor additional children in wealthier families, but this declines as parity increases. So, factorial designs with hypothetical vignettes can be relatively easily used to access respondents' opinions on topics, without having to directly ask a respondent about their behavior.

PRIMING

Primes were also often embedded within a larger traditional survey, and were used in online or computer based surveys and in-person interviews with university populations (Cohen and Belsky, 2008; DelPriore and Hill, 2013; Dunkel et al, 2009 and 2010, Griskevicius et al, 2011a and 2011b; Hill and DelPriore, 2013; Hill et al, 2013 and 2014; Marshall and Shepherd, unpublished), and the general public in developed and developing countries (Auspurg et al 2013; Eurich, 2012; Fritsche et al, 2007; Little et al, 2007; Mathews and Sear, 2008; Taubman and Katz, 2008; van der Wal et al, 2013; Wisman and Goldenberg, 2005; Yaakobi et al, 2014; Zhou, 2008 and 2009). We found no examples of primes being used in traditional societies to study reproductive behavior.

Priming is relevantly common in experimental psychology and other branches of psychology. Priming is used to elicit an implicit memory effect whereby exposure to one stimulus influences how respondent react to another stimulus. It involves respondents being randomly assigned to different conditions, at least one of which is a priming condition, and usually one is a control condition or priming in the opposite direction.

The literature reviewed here that uses priming falls into three main theoretical categories Terror Management Theory, Life History Theory and Attachment Style. This literature used priming to investigate the effects of Mortality Salience, Resource Stress, Partner Insecurity, Childhood Stress, Father Absence, Mating Preferences, Religiosity and Sexual Coercion on factors associated with reproductive behavior (e.g. discounting the future and preference for being around children over adults). For example, Griskevicius et al (2011b) primed mortality. In the mortality condition respondents read a 600 word essay on increased deaths in US due to violent crimes, which stressed the randomness of these crimes. The essay was formatted to look like an online New York Times article. In the control condition respondents read a similarly formatted essay on a man losing his keys and looking around the house for them. Pretests with 24 women and 20 men showed that both articles elicited similar degrees of emotional arousal, but only the mortality article elicited uncertainty about the future and greater perceived danger in the future. Subjects were told the articles were part of a memory test and they would be asked to recall details of it later (it is considered important not to alert respondents to the prime). After reading an article subjects answered questions on family planning decisions with randomized ordering of questions ((1) would you like to have a child in the next few years?(2) if you were to have a child in the next few years, how would you feel? (3) how disappointed would you feel if you did not have a child in the next few years? Griskevicius et al (2011b) found that respondents' childhood SES, and subsequent dispositional life history strategy, mediated their behavior in response to mortality cues in adulthood. People raised in subjectively poorer economic environments had more positive attitudes toward having children earlier when mortality primed. People raised in subjectively wealth environments had more negative attitudes towards reproducing earlier when mortality primed.

Griskevicius et al (2011b) primed respondents through having them read a block of text. This was found to be a common method (Cohen and Belsky, 2008; Dunkel et al, 2009 and 2010; Griskevicius et al 2011a; Hill et al, 2014; Little et al, 2007). Other methods of priming found include word completion tasks (Zhou et al, 2008 and 2009), photos (Hill et al, 2013; van der Wal et al, 2013), asking respondents to think about X (Fritsche et al, 2007; Taubman and Katz, 2008; Wisman and Goledenberg, 2005;Yaakobi et al, 2014),

memory essays (DelPriore and Hill, 2013; Hill and DelPriore, 2013), and preceding questions (Auspurg et al 2013; Eurich, 2012; Marshall and Shepherd, unpublished; Mathews and Sear, 2008).

Regarding using primes within research that is theoretically based in Life History Theory, many papers stressed the importance of finding respondents' dispositional life history strategy (Dunkel et al, 2009 and 2010; Griskevicius et al, 2011a and 2011b; Hill et al, 2013 and 2014). The life history strategy respondents were sensitized to in childhood strongly influences their adult behavior when primed. Many paper also showed that it is relatively easy to shift respondents' behavior, within their dispositional life history strategy, by altering their perceptions of their external environment, among other things. However, most priming methods would be inappropriate for traditional and illiterate populations, and do not retain validity after direct translation (e.g. word completion tasks). For an independent measure, the photograph method of van der Wal et al (2013), where respondents were shown photographs of natural (resource rich) or urban (resource stressed) environments to elicit differences in future discounting, would likely transfer well cross-cultural with only minimal alteration for cultural relevancy. For a dependent measure, the photograph method of Hill and DelPriore (2013) and Maestripieri et al (2004) is noteworthy. Here respondents' interest in infants is assessed by seeing if respondents favor infant or adult faces among paired photos. This may be a useful method to measure respondents' interest in infants and children, in addition to directly asking about respondents' interests in childbearing and parenting.

PROPOSED METHODS FOR MEASURING REPRODUCTIVE MOTIVATION

As the NESCent group's interest is chiefly in the effectiveness of various personal or ecological cues in reproductive motivation, the main experimental method to be used is likely to be priming. Variation will mostly come in the way of then measuring the motivation (or demotivation), both for literate and non-literate populations. For a non-literate population and/or in the field measures like those in Clutterbuck et al 2014 could be useful as they rely on people picking their favourites from among pictures and/or silhouettes of infants or adults. In Zhou et al 2009 the viewing time of such images was also measured, but this obviously needs a computer screen. For literate populations, word completion tasks can be used (Zhou et al 2008; 2009) to unobtrusively measure to what extent people are thinking about offspring. Methods in general might also need to be quite simple to administer if there is no access to a psychology lab, though it is possible to carry out even quite complex procedures like the Implicit Association Test (see below) on internet survey platforms such as Social Sci using a general population sample.

Direct measures of reproductive motivation can be used e.g. a self-report questionnaire or scale responses after priming. This relies on people's conscious appraisal of their attitudes etc. As most human cognition is outside consciousness, it might be useful to supplement this measurement format with more indirect, implicit measures. People might not have the motivation, opportunity, ability and awareness to report their motivations verbally (Nosek et al, 2011).

It should be remembered that most measures are implicit to some extent, as long as they do not directly ask participants what motivates them to have/not have children. One popular implicit measure is the Implicit Association Test which is thought to be a measure of attitudes, particularly those which may be affected by social desirability. It has been used to measure people's implicit racist attitudes by measuring the strength of associations between concepts (e.g. black-good; black-bad) using reaction times. It could be used with or without priming to test ecological cues which might motivate reproduction, or attitudes which people already hold regarding reproduction, respectively. However, some argue it measures not implicit attitudes as much as the general salience of certain concepts (Rothermund & Wentura, 2004).

TOPIC/CLUSTER SUMMARIES

Within all such observational work, emerging motivators or demotivators could be used as experimental primes to influence reported childbearing intentions. Different motivational items would be expected to be motivational depending on the context.

ATTACHMENT FERTILITY THEORY

Attachment Fertility Theory (ATF) proposes that close enduring relationships are an evolved adaptation to expensive offspring -- offspring that require huge amounts of parental care from multiple care-givers. Close enduring relationships help ensure long-term mating whereby any offspring from the union are sufficiently provided for. Miller et al (2013) propose that long-term mating is the evolved preferred strategy for both males and females, and that short-term mating and other mating behaviours are all outcomes of ATF responding to different ecological conditions and mating opportunities.

Therefore, there is no real difference between the sexes in mate preferences, but rather individual differences based on access to an appropriate mate and subsequent emotional closeness to a mate – mating occurs on a continuum with females tending to one side and males the other, but there is extensive overlap. Miller et al (2013) discuss a study with homosexual men in which emotional closeness to primary partner reduced sexual risk taking, and a loss of emotional closeness to primary partner increased sexual risk taking.

Idea -- Closeness of relationship to partner may be indicative of resource access/security and fidelity, which are relevant for fertility decision making and can perceptions of partner characteristics can be manipulated through priming, etc.

ATTACHMENT STYLE

Studies on attachment style take as a starting-point the idea that how infants are treated by caregivers can potentially result in lasting personal styles in how relationships (especially romantic) are formed by the adult individual. Those who were insecurely attached tend to as adults according to Belsky (2012), have early pubertal maturation and sexual debut, a tendency toward forming short-term and unstable pair bonds, and limited parental investment geared toward bearing more children but not caring for them intensively, all of which is adaptive in a harsh and/or unpredictable environment. Two types of insecure attachment emerging from the mainstream psychological literature are avoidant, i.e. those who tend to avoid intimacy and close personal relationships; and anxious-ambivalent, where people are clingy and fear they will be abandoned by their partners. Rholes et al (1995) found that more

avoidant people express less desire to have children than more secure people, and also express stronger worries about being a good parent than do securely attached people. Anxious-ambivalent people were concerned about their capacity to be a good parent, but their attachment style was not related to desire for children. Neither attachment style predicted perceived psychological costs of childrearing. A later study (Rholes et al 1997) found that avoidantly attached people believed that their children would exhibit negative/insecure behaviour; while anxious-ambivalently attached people did not expect this. The authors speculate that in line with Belsky's evolutionary attachment theorising, avoidantly attached people may still have children despite low desire due to social norms; but that they may offer lower parental investment. A study showing overlap between attachment style research and the mortality salience research is that by Yaakobi et al (2014), where induced mortality salience increased both implicit and explicit parenthood-related thoughts, but only in those low in avoidant attachment. It seems that avoidantly attached people do not use thoughts of relationships (parenthood or romantic) to deal with mortality-related stress. However, if they are primed with the notion that parenthood is compatible with career success, mortality salience can give them parenthood-related thoughts.

BABY FEVER

Here are included attempts to anatomise 'baby fever', the visceral physical and emotional desire to have a baby. Brase & Brase 2012 used findings from a UK undergraduate sample and generalised them to a population sample to create the Attitudes towards Babies scale. Three reliable factors underlying baby fever were Positive Exposure, Negative Exposure and Tradeoffs. The first two were more experiential and visceral, the latter more deliberative and conscious. Females had more frequent and stronger baby fever, while males had a stronger desire for sex. Rotkirch's 2007 research in Finland investigated female baby fever using interviews and found that triggers include physical age (early 20s or ages 28-35), falling in love, previous pregnancies and exposure to babies of kin and peers. It can manifest as a care-oriented personality; and sometimes as a surprising physical longing described as being similar to other biological drives. Rotkirch et al (2011) studied male baby fever using Finnish survey data and found that it generally began before attempts to conceive, although a third of men had it triggered by attempting to do so. For men it was not triggered by educational or economic status, but it increased if a man was married; if there was an intention to have a child; and the higher the number of lifetime romantic unions. The author speculates that in low-fertility societies with wide female reproductive choice, this longing for a baby might be of increasing importance. Baby fever is considered to be different from need to nurture by most researchers (see [*Nurture*](#)).

CHILDLESSNESS/POSTPONEMENT

Research investigating fertility postponement in high-income countries and for some, the ensuing childlessness, finds that people adjust their fertility desires (Gray et al 2013), contrary to previous theorising which says that only fertility intentions change in response to situational factors. While short-term factors such as poor health or joblessness do not greatly influence fertility desires, both age and relationship status do effect a change, with goal adjustment if desires are unlikely to be fulfilled. And Schytt et al's 2014 Swedish study found that although most 28- or 32-year-olds questioned intended to become parents in future, 45% of 36/40-year-old women and 39% of 36/40-year-old men didn't intend to have children, with many also uncertain. The older the participants the more common problems in conceiving as well as a lack of suitable partner. For younger people postponement was associated with concerns regarding independence, career and economic matters. Factors that are associated with postponement of reproduction could be primed to see if they affect fertility motivation; as well as factors associated with remaining childless at the oldest (infertile) ages to see if they promote fertility motivation in younger people (i.e. acting as a warning).

CHILDHOOD STRESS

Clutterbuck et al's (2014) research studies interest in infants as a putative mechanism linking childhood adversity and reproductive timing using data from English girls aged 9-14. They measure interest in infants in three ways: self-report, a forced-choice visual stimulus preference task, and a computer-based attention task, but find poor inter-measure correlation, suggesting weak construct validity. In line with predictions, those with greater childhood adversity reported an earlier ideal age at parenthood, but against predictions, those with less childhood adversity were more interested in infants. As there was no relationship between intended reproductive timing and interest in infants, the authors suggest that interest in infants may not indicate intended age at first but may actually indicate future parental investment strategy. As Belsky (2012) summarises, lower childhood adversity may bias individuals towards a slower, quality-led, reproductive strategy. Several papers examine how the life history strategy people are sensitized to in childhood influences their responses to priming of environmental harshness in adulthood (Griskevicius et al, 2011a and 2011b; Hill et al, 2013 and 2014; Hill and DelPriore, 2013; Dunkel 2009, 2010, 2011). For example, Griskevicius et al's (2011b) experiments show that current environment can shift risk taking and temporal preferences, though the direction is affected by childhood socioeconomic situation. People sensitized to a slow life history strategy are willing to take larger risks, but when mortality is cued become very cautious; while people sensitized to a fast life history strategy are more cautious and then become risk takers when mortality is cued. Childhood experience sensitizes life history strategy such that individuals follow fast or slow life history strategies depending on childhood environment, and then respond differently, but evolutionarily adaptively "for them", when faced with mortality cues as adults. See *Life History Theory*

Idea – Important to know respondents' dispositional life history set in childhood as this affects how they respond to environmental cues as adults.

CONTRACEPTIVE USE

Studies on contraceptive use largely focus on what motivates effective contraceptive use vs. either ineffective/inconsistent use or non-use. Work on sexual risk taking often also addresses contraceptive use. US women are more likely to inconsistently and unsuccessfully use contraceptives if they are poorly motivated to not reproduce (in a committed relationship, perceive partner as strongly committed and resource "rich", wants (more) children and soon, negative self-image that they perceive will be fixed by motherhood, and traditional female role orientated, and contraceptive method requires a definite decision and use at each coitus act (e.g. condoms)); perceive contraceptive use to be risky or negative; have more negative attitudes towards contraceptives in general; husband/partner is unsupportive of that contraceptive method, personality of woman allows for integration of repetitive stable behaviours such as regular contraceptive use (Miller, 1986); and if they have low power in the relationship or they are trying to introduce contraceptives in to a long-term committed relationship (fear suggests infidelity) (Woolf and Maisto, 2008). Miller (1986) also notes that women's use of contraceptives fluctuates as their motivation to remain childless changes with their economic, relationship, social and cultural situation. For example, married women are motivated to use contraceptives by their ideal family size and preferred length of inter-birth intervals, while single women are motivated by cultural norms to only reproduce within stable unions. From a life history perspective, Chipman and Morrison (2014), suggest that fertility preferences form in childhood, and that adolescent sexual risk taking and pregnancy is due to perceptions of high risk in the environment and good access to alloparents/cooperative breeding networks, rather than poor knowledge of safe sexual practices or structural risk in the environment. DelPriore and Hill (2013) further support this as they found that priming father absence/paternal disengagement in undergraduate women encouraged sexual permissiveness and sexual risk taking (less likely to use contraceptives). Only DelPriore and Hill (2013) used experimental methods (through priming paternal disengagement) to examine variation in interest in contraceptive use by women. Woolf and Maisto (2008) used experimental methods (hypothetical vignettes presented in a factorial design) to show how both men and women find it difficult to initiate contraceptive use in low power situations and that it is more difficult in committed relationships than brief sexual encounters.

Idea -- It may be possible to use existing/ intended contraceptive use as a proxy for sexual risk taking and/or interest in reproducing post-priming. Priming respondents for environment harshness should affect contraceptive use with dispositional fast LHS women expressing more negative attitudes towards contraceptives and a greater desire to reproduce soon, and dispositional slow LHS women expressing more positive attitudes towards contraceptives and a greater desire to delay reproduction until the environment improves.

COOPERATIVE BREEDING/KIN HELP

Most research on kin help focused on help from grandparents. Chipman and Morrison (2014) found that access to grandparental investment increased propensity for sexual risk taking, and reduced preferred and realized age at first birth. Waynforth (2012) found that, among a British cohort born in 1970, financial dependency on parents delayed and limited reproduction, but being close to parents and seeing parents frequently increased reproduction between ages 30-34. This suggests that temporal kin support is more important than resource based kin support in encouraging fertility. Ever

receiving childcare from grandparents also predicted lower birth probability between ages 30-34. Newson et al (2007), using vignettes, found some evidence to support that inclusive fitness is maximized more when reproduction occurs in situations where resources/familial support are more plentiful. "Mothers" are more supportive of daughters' reproduction under situations of positive resource access than "friends", and less supportive under negative resource situations than "friends", suggesting the value of resource access and social support are salient factors in fertility planning. Miller et al (2013) suggest that women need help from others to support their expensive offspring, and that this is facilitated by evolved adaptations that encourage close and enduring relationships among adults. Chasiotis et al (2006) suggest that we are predisposed to parental attachment and providing parental care due to evolved mechanisms of nepotistic altruism. Furthermore, experience with younger siblings encourages positive attitudes towards childbearing, higher fertility and earlier age at first birth. The importance of paternal parental care is usually discussed in terms of daughter's adolescent and adult sexual risk taking. See Father Absence for more details. Auspurg et al (2013) looked at how preceding questions on respondents' social network affected responses to later questions on respondent's fertility intentions. Auspurg et al (2013) expected that respondents in thinking about their close social network (particular their relatives) would be primed to consider individuals who are likely to support their childbearing and provide informal 'free' childcare; thus, reducing the perceived cost of children and encouraging higher fertility intentions. However, despite preceding questions' priming effect on fertility being an established issue (Mathews and Sear, 2008; Mathews, 2012) no effect of preceding social networks questions was found. Auspurg et al (2013) used experimental methods, though their prime may have been too weak and their dependent measure influenced by too many alternate factors. How kin may influence fertility intentions and behaviours is also discussed in Cultural Norms.

Idea – Take Auspurg et al's (2013) idea that priming social networks leads people to think about their available social support, thus reducing their perceived cost of children and increasing their fertility intentions, but be more direct with the prime and change the independent measure to perceived cost per child or fertility desires rather than intentions.

COST OF OFFSPRING

Straits (1985) found using vignettes that women favoured wealthy families having more children and disfavoured continued reproduction in poorer families, but favouring reproduction in wealthy families declined as parity increased. This suggested that direct cost of children is a salient theme in fertility decision making. Indirect costs, e.g. motherhood vs. career advancement, are less salient than direct costs and most women favoured motherhood even over significant career advancements. These effects were tempered by perceived cultural support of parenthood. Auspurg et al (2013) suggest that priming respondents about their close social networks leads them to think about individuals who would encourage and support their childbearing, and individuals who would provide free childcare. This priming of available alloparents and social support for childbearing should increase people's fertility intentions by reducing the perceived cost of children. However, their results did not support their predictions, this may be due to more direct primes than preceding questions being required to activate the relate psychology, or a direct measure of perceived cost of children being needed as fertility intentions are a result of numerous factors not just perceived social support. Mathews

and Sear (2008) found that under mortality priming respondents tended towards perceiving children as less costly. Kushnick (2013) suggests that mothers use simple heuristics, rather than a full accounting of present and future costs and benefits of reproduction, when making their fertility and parental investment decisions. Kushnick (2013) used a factorial vignette design to explore evolved decision pathways in women from two rural villages in Indonesia – this shows the methodology can be used in relatively uneducated non-Western populations. Rholes et al (1995) explored psychological costs of childrearing within the context of Attachment Style. They found the psychological cost of childrearing, as measured in undergraduates, was not affected by gender or attachment style.

Factors associated with offspring cost are likely easy to manipulate, e.g. offspring's need for education and parental investment of time. Some discussion of temporal and resource needs of offspring is discussed in Parental Investment.

CULTURAL NORMS

Cultural norms are addressed in terms of modelling associates fertility behaviour, meeting behavioural expectations of significant others, preferring culturally sanctioned normative to deviant behaviour, and how population level shifts in expectations of women affect fertility. Adair (2010) found that respondents to her structured survey integrated information about fertility timing from their peers' fertility behaviour (their local cultural norm?), and Philipov et al (2009) suggest that in a large European sample subjective fertility norm and influence of important others affect peoples' fertility intentions. Philipov et al (2009) and Philipov (2011) use the Theory of Planned Behaviour, of which important components are perceived expectations of others and motivation to comply with them. These normative beliefs combine to give a subjective norm in regards to reproduction. Ajzen and Klobas (2013) continue work within the Theory of Planned Behaviour and suggest that subjective norms (SN) with respect to having a child are determined by all readily accessible normative beliefs in relation to important referents, weighted by motivation to comply with referent. They found that across eight developed countries subjective norms influenced fertility intentions in all but France. They suggest that the French have greater independence from family and other influencers. Straits (1985) proposed that fertility decline is due, in part, to decreased cultural support of parenthood. Found, using vignettes with a 2x3 factorial design, that fertility change is indeed linked to inter-cohort shifts in values and expectations of women, specifically fertility declines if there is less cultural support of motherhood and more cultural support of women's career investment. Adair (2010) also found evidence that values and expectations of women affect fertility: (1) couples with traditional views on female roles had more positive attitudes towards babies and couples with more work-orientated views had negative attitudes towards babies; (2) women who experience more culture pressure to have children have younger preferred ages at first birth; and (3) relationship status affected fertility desires, attitudes and plans such that singletons had more negative attitudes towards babies, later preferred ages at first birth, and smaller preferred completed family sizes. Adair's (2010) latter finding links with Miller's (1986) work which suggests that single women are motivated, by culture norms, to only reproduce within stable unions. In addition, Newson et al (2007) suggests that women are more approving of new pregnancies in women who are within cultural sanctioned norms rather than cultural deviants (e.g. a widow having a child is better than a single woman). The interplay of cultural norms and individual biological drives may

be of interest. For example, the *Baby Fever* literature suggests that baby fever can occur in late teens to early 20s in western women despite prevailing culture norms and expectations for women to delay reproduction until an education and career have been attained (Rotkirch, 2007).

CLOSENESS TO PARTNER

A number of studies indicate that the quality of relationship between a woman and her partner predicts feelings regarding progression to birth. Wilson & Koo's (2006) survey of low-income women in the south-east US finds that, all else equal, being in an established relationship; not having had a previous child with their partner; and having high expectations of their partner in terms of his emotional/financial support predicted higher desire for a child with him. Positive factors also included the knowledge that there would be a continued relationship with his relatives even if the relationship ended. Carter et al's 2013 study of young black and Puerto Rican people in two US cities found a number of factors predicted positive feelings about a potential pregnancy in their current relationship. These included longer relationship duration (including cohabitation); higher frequency of sex; not having a previous child; and partner's positive feelings about a pregnancy. A Dutch survey from Rijken & Thomson 2011 found that women's perceptions of relationship quality affects progression to first birth; whereas second birth progression is also affected by men's perceptions. However, women in medium-quality relationships are the most likely to have a(nother) child, perhaps because women in high-quality relationships are especially aware of the potentially detrimental effect that offspring can have on romance. For men, being in a medium- or high-quality relationship increased the likelihood of having a second child. Quality was assessed with measures of support, conflict and stability.

FATHER ABSENCE

This literature (e.g. Belsky 2012) says that father absence makes females in particular gravitate towards a faster life history strategy without first securing help from a reliable male to help parent. An experimental investigation of this was by DelPriore and Hill (2013), who primed paternal absence or disengagement in a series of five experiments by making women think about an important time in their life when their father was unavailable. Cues of paternal disengagement made women think more sexualised thoughts; increased self-reported sexual permissiveness and negativity towards condom use, all indirectly potentially related to fertility outcomes. Maestripieri et al (2004)'s survey of 11-14-year-old girls finds that father absence is strongly and independently correlated with both early menarche and preferences for pictures and silhouettes of infants, adjusting for age and previous experience with infants. Clutterbuck et al 2014 used similar stimuli with 9-14-year-old girls and found that those with less childhood adversity (including father absence) were more interested in infants, contrary to predictions. The authors speculate that interest in infants may not indicate earlier intended age at first birth but may actually indicate a future quality-led parental investment strategy, as in the attachment literature (including Belsky).

FERTILITY DESIRES/INTENTIONS: GENERAL

There is a large demographic literature in fertility desires/intentions, with the assumption that fertility is consciously planned or desired before it occurs. McQuillan et al 2011 find in a survey of sexually active US women that 23% of

them are “okay either way” regarding whether they get pregnant. All else equal, those in this group (compared to those who are trying to get pregnant) tend to have lower fertility intentions, think motherhood less important; tend to have higher age and parity; are less likely to self-identify as having a fertility problem; and are less likely to be black. The odds of trying to get pregnant compared with being okay either way decline with each additional child. The study suggests that fertility intentions are on a continuum and that there is ambivalence regarding pregnancy. Roberts et al (2011) spoke to childless urban Canadian men aged 20-45 and found that 86% said they planned to become a father at some point. More than half felt financial security to be very influential as a precondition for parenthood; followed by partner's interest in having children; and then their partner's suitability to parent. Those aged 35-45 had the highest odds of saying their 'biological clock' was influential in their childbearing intentions. Kariman et al 2014 spoke with Iranian women who were either pregnant for the first time or still using contraception. Their main concerns revolved around fears of infertility and associated stigma; fear of tensions between employment and childbearing; fear of having one's freedom limited; and fear of current social conditions. Some were sceptical of their husband's ability to be a good parent; and also of the robustness of their marriage, their own childcare abilities, and their own physical and mental readiness for a child. All participants expressed concerns regarding financial security, even those with a high income. Paradoxically many participants also expressed hope and trust in both God's providence and in their own ability to develop a sense of purpose in childbearing and increased resolution of financial problems.

HERITABILITY

Miller (2011) discusses the possible genetic underpinnings of childbearing behaviour. Looking at siblings and cousins Miller et al (2010, from Miller (2011)) found a heritability component of 70% for fertility desires and 40% for fertility intentions. This could be due to cultural and well as genetic transmission. Miller et al (2000, from Miller (2011)) found three genetic polymorphisms associated with personality traits strongly associated with fertility motivations, desires and intentions. This suggests a possible heritable genetic component to positive attitudes towards childbearing and high fertility. Results for both papers are couched within the *T-D-I-B* framework. However, Chasiotis et al (2006) suggest that caring for younger siblings and the pronatal effect this has may explain correlation in family size between generations, and why fertility decline takes at least a generation to occur. So, fertility is not heritable, instead being exposed to younger siblings triggers pronatal tendencies and consequently high fertility (see *Cooperative Breeding/Kin Help* and *Nurture*).

LIFE HISTORY THEORY

Numerous papers were theoretically grounded in Life History Theory (LHT). The body of work that directly incorporated LHT includes: (1) what shifts a child on to a fast or slow life history and how this influences adolescent and adult sexual behaviour and fertility desires, intentions and behaviours (see *Childhood Stress* and *Father Absence*); (2) how life history strategy influences attachment style/personality and thus fertility behaviour (*Attachment Style* and *Personality*); (3) how priming different environmental conditions influences individuals' life history strategies and consequently behaviour, mediated by their dispositional life history strategy (*Mating Preferences/Choice*, *Mortality Salience*, *Parental Investment*, *Partner Insecurity*, *Resource Stress/Limitation*,

and *Sexual Coercion*) – this includes time discounting of which there is a large economics literature; and (4) general discussions of how life history strategy influences desire for children (*Baby Fever* and *Nurture*). The most explicit work within LHT investigated how respondents in neutral environments (e.g. undergraduates from both harsh and non-harsh childhood environments exhibit similar behaviour), by reading hypothetical vignettes about their life expectancy (Dunkel et al, 2009, 2010, 2011) or fictional newspaper articles suggesting higher mortality risk in their local environment or resource scarcity (Griskevicius et al, 2011a, 2011b; Hill et al, 2013 and 2014), shift their behavioural preferences, and how this is mediated by the life history strategy they were calibrated to in childhood. For example, Hill et al (2013 and 2014) found that women and men sensitized to a fast life history strategy when primed for a harsh environment favoured larger female body sizes (i.e. those better able to reproduce in a harsh environment) and the women were less concerned with dieting and favoured a larger body size for themselves. Women sensitized to a slow life history strategy favoured smaller female body sizes and were more concerned with dieting, which would hinder reproduction in a harsh environment allowing women to delay reproduction until the environmental conditions improve. Van der Wal et al (2013) did an interesting study using photos of natural vs. urban environments, or walking through a forest vs. a city. Found that exposure to natural environments reduced future discounting and happier moods. Van der Wal et al (2013) suggest this is related to the biophilia hypothesis: humans have a natural affiliation to nature/living things. In natural environment resources were perceived to be plentiful and competition low, while in urban environment resources were perceived to be scarce and competition high. The natural environment thus encouraged a slower life history strategy, and the urban environment a faster life history strategy.

Idea – van der Wal et al's (2013) method may be valuable in cross-cultural studies, although the type of natural environments shown may need to be altered for cultural relevance.

MATING PREFERENCES/CHOICE

This literature was considered as it looked at how respondents life history strategy affects their decisions and future discounting. The methods used are likely transferable to studies that look at the consequences of mate preferences and mating. Little et al (2007) showed the short vignettes can be used to prime harsh and safe ecological conditions, and in turn elicit markedly different long-term mate choice preferences from respondents. Under ecologically harsh conditions men and women favoured low-quality/high-investment partners for long-term relationships, i.e. partners able to provide for children were favoured at the expense of genetic quality suggesting the cost of offspring rather than offspring's "health" or "attractiveness" to future mates is a salient concern. For short-term relationships, where investment is unimportant, high-quality partners were favoured regardless of ecological condition. Cohen and Belsky's (2008) work somewhat supports Little et al's (2007) findings. Cohen and Belsky (2008) primed undergraduate women with three vignettes that suggested their local ecological condition was predictable and safe, predictable but risky, unpredictable and fluctuated between safe and risky. Under predictably safe conditions women desired a longer-term relationship and valued partners who were sexually faithful, interested in long-term relationships and parental investment more than under the unpredictable safe-risky and predictably risky conditions. Women favoured partners who were good at getting resources more under the predictably safe condition. Found

little evidence of attachment style affecting mate preference in this study. Hill et al (2014) found that women and men, sensitized to a fast life history strategy, when primed for a harsh environment favoured larger female body sizes (i.e. those better able to reproduce in a harsh environment). Dunkel et al (2009) found that priming different life expectancies affected preferences for short- or long-term mating and this is mediated by the dispositional life history strategy respondents were sensitized to in childhood. This study is noteworthy as it had a within and between subjects design, such that subjects read each of the hypothetical life expectancy vignettes (in random order) and answered mate choice questions after each one. Males and participants that scored lower on the Mini-K and FTP scale reported greater interest in short-term mating. Females and participants that scored higher on the Mini-K reported greater long-term mating preferences. For both sexes cuing a shorter life expectancy encouraged a greater preference for short-term mating, and cuing a longer life expectancy a preference for long-term mating. Chipman and Morrison (2013) discuss the importance of operational sex ratio in relation to male-biased populations favouring female mate choice and female-biased populations favouring male mate choice, and how this affects union formation, stability, and reproduction (including age at first birth and reproduction outside of committed unions). Lainiala and Miettinen (2014) discuss how secondary sex ratio affects union formation and fertility. See *Sex Ratios* for more details. How mate choice and emotional closeness affects sexual risk taking, and likely reproduction, is discussed in *Attachment Fertility Theory*.

MORTALITY SALIENCE

There is substantial evidence that encouraging people to think about death increases childbearing motivation. This has taken the form of experimental studies both in the psychological field of Terror Management Theory, which states that people use parenthood as a way of mitigating death-related anxiety; and in research influenced by *Life History Theory* and its emphasis on (perceived) local mortality schedules. Wisman and Goldenberg's (2005) Dutch research found that mortality salience triggered desire for more offspring in men; while females in the experimental condition showed a non-significant trend for wanting fewer. This gender difference seemed to be the result of perceived tradeoffs between children and career in career-minded females, as when women were then primed with information that the two were compatible, they wanted more offspring in the mortality salience condition, similar to the earlier male results. Fritsche et al (2007) discovered that following a mortality prime, German undergraduates were more likely to say they wanted at least one child, and were more likely to use offspring-related words compared to controls. There was no sex interaction, possibly because people were asked only if they wanted children at all, rather than how many. In China, Zhou et al (2008) discovered that people primed with mortality were more disapproving of the one-child policy than controls. They also found that terminally ill hospital patients preferred family members under 5 to older family members more, in comparison to a non-terminally ill patient group. Follow-up work by Zhou et al (2009) showed that students instructed to think about death preferred pictures of young children and viewed them longer than pictures of adults or objects. Taubman-Ben-Ari & Katz-Ben-Ami (2008) discovered that in an Israeli sample, priming mortality salience induced higher maternal separation anxiety compared to a control group, but contrary to predictions this did not interact with attachment style. Mathews and Sear (2008) discovered that males primed with mortality salience had a higher ideal number of children, but that there was no such effect for females, perhaps because lower male costs to parenting mean that they are more liable to facultative adjustment of these

desires. Pepper and Nettle (2013)'s internet survey of North Americans found associations between number of close bereavements within the last 5 years and a lower ideal age at first birth; increased hazard of actual first birth at any given age; and steeper financial future discounting; while controlling for age, sex, income and SES.

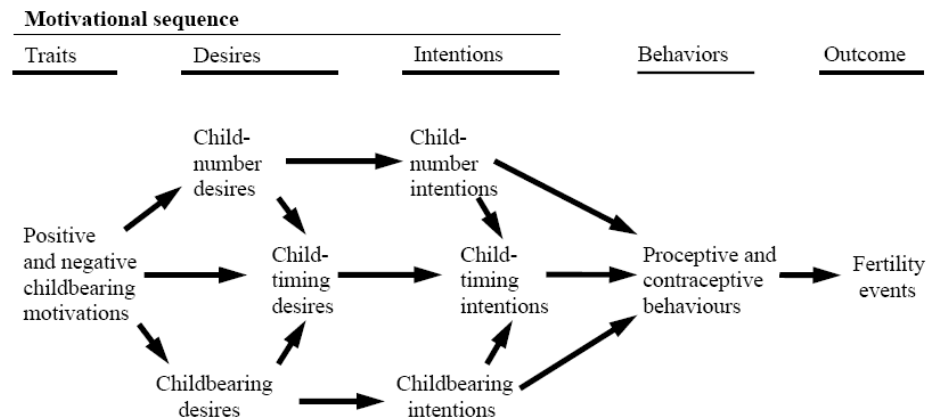
Dunkel et al (2009, 2010a and 2010b) used hypothetical vignettes suggesting respondents had life expectancies of 5 months, 5 years or 50 years and found that: men and women with shorter life expectancies were more willing to sexually coerce a partner; men and women with shorter life expectancies had more aggressive and less generative tendencies, with people sensitized to faster life history strategies and men being more aggressive; and, for both sexes, cuing a shorter life expectancy encouraged a greater preference for short-term mating, and cuing a longer life expectancy a preference for long-term mating (see Sexual Coercion and Mating Preferences/Choice). In general Dunkel et al's (2009, 2010a and 2010b) work shows the relative ease with which perceived life expectancy can be manipulated and that this influences people's life history strategy, although this is moderated by sex and dispositional life history strategy. Griskevicius et al (2011a and 2011b) used a fictional newspaper article to suggest high mortality due to violent crime and unpredictability in respondents' local environment. They found, experimentally, that life history strategies, and the psychologies associated with different strategies, can shift as a function of mortality cues in a person's adult environment. It is important to note that this research shows that life history strategies do not appear to shift in a straightforward manner. Instead, mortality cues appear to shift strategies in a divergent manner as a function of one's childhood SES. The life history strategies of the control subjects were unclear. The variation showed under mortality cues suggesting differences may only emerge under conditions of unpredictability and harshness, otherwise poorer peoples energy budgets may not be especially constrained compared to others (see Childhood Stress for more on Griskevicius et al's work). Hill et al (2013 and 2014), using the newspaper article from Griskevicius et al's (2011a and 2011b) work, also found that men's and women's life history strategies appear similar under benign conditions. When primed for high mortality in their local environment dispositional life history strategy moderated men's and women's female body size preferences (see Life History Theory for further discussion of this). Mortality salience is also considered by Yaakobi et al (2014) in relation to how, with attachment style, it influences interest in parenting (see Attachment Style); and by Chipman and Morrison (2014) in relation to how perceptions of low local life expectancy, and high risk, lead adolescents' to have more positive attitudes toward teenage pregnancy (see Contraceptive Use), i.e. favour a fast life history strategy with early reproduction. Belsky's (2012) paper also discusses how environmental risk and unpredictability in childhood affect both psychologically and possibly physiological adult life history strategy and associated time preferences (see Childhood Stress and Father Absence for more of Belsky's work)

MOTIVATION/TRAIT-DESIRE-INTENTION-BEHAVIORS

The Traits-Desires-Intentions-Behavior (T-D-I-B) framework is built around the sequence of motivational dispositions and conscious states that lead humans to behave so as to have or avoid having children (Figure 1). The framework starts with positive and negative childbearing motivational TRAITS. These traits lead to DESIRES for or against having children. These desires lead to corresponding fertility INTENTIONS. These intentions lead to BEHAVIORS orientated towards either the achievement or avoidance of pregnancy (e.g.

proceptivity or contraceptive use). Warren “Rennie” Miller has been working with this theory for decades, and several colleagues have picked up on it. For example, Miller (1986) investigated motivation behind contraceptive non-use (see *Contraceptive Use*), leading to Miller (1995) where Rennie’s Childbearing Motivation Questionnaire is discussed and found in a longitudinal study to show that positive childbearing motivation (PCM) and negative childbearing motivation (NCM) affect fertility desires and intentions, and proceptive behaviour. PCM and NCM are distinct factors affecting desires and intentions, which in turn influence proceptive behaviour. PCM and NCM most strongly influence desires, and have some direct influence on intentions but mostly indirect through desires. Miller (2011a) argues that desires and intentions are distinct factors and both need to be addressed. Both fertility desires and intentions are developmental in nature and are expected to change over a person’s lifetime due to changes in external, social and economic constraints, and internal maturational factors, including decisions made that are competitive with childbearing. Fertility decisions are made one birth at a time, with each birth feeding back upon individual fertility desires and intentions. Each major life event in other behavioural domains (e.g. education, career partner relations) also feeding back into the system. Miller (2011a) also discusses evidence for genetic components of fertility motivation mediated through personality (see *Personality*, *Nurture* and *Figure 2*) and that there are heritable components of fertility desires. The T-D-I-B framework has been compared to the Theory of Planned Behavior and Miller (2011b) addresses this and discusses the differences and value of both (see *Theory of Planned Behavior* and *Figure 3*).

Figure 1: Taken from Miller (2011a) showing the T-D-I-B framework and the interactions between the traits/motivations and subsequent desires, intentions, behaviours and outcomes.



MOTIVATIONS: GENERAL SCALE CONSTRUCTION

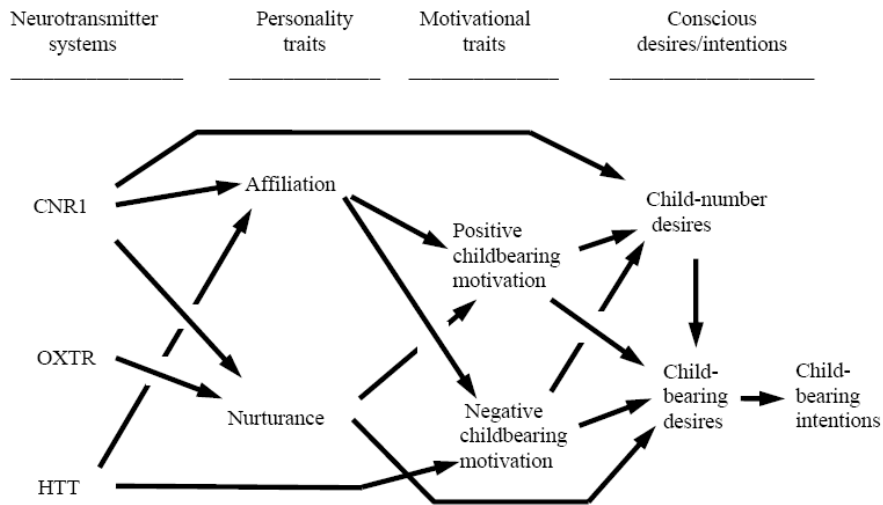
Many attempts have been made to construct scales measuring childbearing motivation, although arguably these may be more relevant in contexts where the default is to not have children. Langdridge et al 2005 used a sample of white married UK couples yet to have a child to investigate reasons behind fertility intentions and discriminate intenders from non-intenders. The chief discriminator between the groups was for both sexes the belief that children will bring fulfilment. For non-intenders, men rated the reasons ‘less time with

partner', 'emotional strain', 'interfere with career', 'responsibility', and 'lack patience' more highly than women did, while women rated one reason (partner's wishes) more highly than men. In Portugal, Guedes et al 2013 used rigorous methodology finding four positive motivational factors (socioeconomic aspects, personal fulfilment, continuity and the couple relationship); and five negative factors (childrearing burden and immaturity, social and ecological worry, marital stress, financial problems and economic constraints, and physical suffering and body image concerns).

NURTURE

Miller (2011a) discusses the genetic underpinnings of fertility motivation and suggests a genetic component to nurturance personality traits. Cannabinoid receptors and oxytocin receptors were found to be associated with nurturance personality traits. Nurturance personality traits were directly associated with positive childbearing motivation and childbearing desires, and indirectly with child-number desires and childbearing intentions (*Figure 2*). Basten (2009) also debates whether a need to nurture is biologically programmed, but from an evolutionary psychology standpoint. Basten (2009) suggests that human children need to be nurtured to become successful adults, and adults need to nurture to grow up and accomplish a full life cycle of experiences. However, the need to nurture is strongest in women and varies throughout the life course, being strongest in parents with children ≤ 4 years old. It may have partially evolved through mate selection, as nurturing behaviour advertises parenting quality to potential mates. The strength of the need to nurture is likely under hormonal control. It is strengthened through building a committed relationship (love), own household formation, and the aging process. It is initially triggered, though, in childhood through nurturing cues such as caring for younger siblings. Therefore, as kin networks decline and family size shrinks the nurturing instinct is becoming less triggered. Exposure to children may encourage nurturing and subsequently desire for children. Chasiotis et al (2006) found that the presence of younger siblings increased fertility intentions in older siblings and lowered their preferred age at first birth across three culturally distinct populations. This study is noteworthy for the care taken to ensure the cross-cultural validity of the survey questions. Adair (2010) found that more frequent exposure to children in adulthood increased fertility desires and plans, and positive attitudes towards babies. Basten (2009) and Rotkirch (2007, see *Baby Fever*) note that baby fever is separate from nurturing personality, and strikes both women who always wanted children and women who previously did not.

Figure 2: Form Miller (2011a). A model showing the links from three genetic polymorphisms to personality traits and the T-D-I-B framework (see Motivation/Traits-Desires-Intentions-Behaviours).



Notes: CNR1, OXTR and HTT indicate variables that measure polymorphisms of, respectively, the cannabinoid receptor, oxytocin receptor and serotonin transporter. Adapted from Miller et al. (2000)

PARENTAL INVESTMENT

This links to Cost of Offspring. Kushnick (2013) used a third-party confounded factorial vignette experiment to investigate the role of five factors— mother’s age and access to resources, and child’s age, gender, and viability—in shaping decisions related to maternal care among Karo Batak agriculturalists from rural Indonesia. Food-secure mothers were judged as being approximately a full step more likely to provide care to offspring than food-insecure mothers. Hill and DelPriore (2013), cued jealousy in respondents and found decreased desired parental investment among only chronically jealous men. Women’s parental investment preferences were not affected by suspected partner infidelity. The difference between the sexes is likely a result of paternity uncertainty in men who suspect they have been cuckolded (see Partner Insecurity). Roberts et al (2011) found that Canadian men feel that financial security (i.e. ability to parentally invest) is a precondition for parenthood, though older and wealthier men were less likely to mention financial security. Parental investment literature also considered the perspective of how the parental investment a respondent received affects their behaviour in adolescence and adulthood, see Childhood Stress and Father Absence. Mating Preferences/Choice also has literature that considers potential ability of partners to parentally invest (e.g. Hill et al (2014)).

PARTNER INSECURITY

Hill and DelPriore (2013) found that cuing jealousy encouraged concerns about partner infidelity. Infidelity concerns decreased parenting interest among chronically jealous men and women, and decreased desired parental investment among chronically jealous men. Jealousy may function to minimize costs associated with paternity uncertainty among men, and loss of resource investment among women. Wilson and Koo (2006) found that low income

women in the southeast of the US had higher desire for children with actual or potential partner if have high expectations of their partner (emotionally and financially supportive) and in a long-term stable relationship. The Culture Norms literature suggests that there are culturally enforced norms that discourage reproduction outside of stable long-term relationships. For example, Newson et al (2007) suggest that women favour pregnancy in others when that other woman is in a secure and committed relationship with a supportive husband, rather than single or with an unsupportive husband. See also Emotional Closeness to Partner.

PERSONALITY

Jokela (2009) finds in a Finnish survey that high sociability increased the likelihood of having a first and second child, but not a third child over a 9-year follow-up period. Emotionality did not predict the first child's birth, but it did decrease the likelihood of having a second and third child. In males, high activity increased the likelihood of a first and second child, but this trait did not predict childbearing in women. Those with high sociability, high activity and low emotionality were more likely to live with a partner. See also Baby Fever, Motivation/Traits-Desires-Intentions-Behaviours, Nurture and Theory of Planned Behaviour. For example, Ajzen and Klobas (2013) consider several known background factors known to be in the fertility domain, including personality. While, Miller (2011a) reports how genetic predispositions towards having affiliative and nurturant personalities encourage positive childbearing motivation, higher child-number desires, and greater childbearing desires and intentions (see Figure 2 in Nurture).

RELIGIOSITY

Eurich (2012) primed Christian affiliation through a single question asked either before or after dependent measures. Eurich theorized that Christians are more sexually restricted and place a greater priority on parenting. Priming subjects Christianity should thus decrease promiscuity and increase valuation of children. Eurich (2012) expected more noticeable effects of priming Christianity in men than women, as women generally seek short-term mates less than men, so have less room to show variation than men. Priming for Christianity significantly decreased reports of promiscuity, but did not impact partner preferences or parenting motivation, and men were not affected more than women. Marshall and Shepherd (unpublished) found no evidence that religion is important in the construction of fertility desires. Aarssen and Altman (2012) found a positive correlation in females between desired fertility and the goal of inspiring others with one's religious belief. Gray et al (2013) found that men with lower religiosity had lower fertility desires. Philipov et al (2009) consider religion to be an important background factor affecting people's attitudes, subjective norms and perceived behavioural control of fertility. They consider religion to be an important context variable and somewhat external to the psychological fertility decision making process. While, Philipov (2011) argues an advantage of the Theory of Planned Behaviour is that does not assume people and their intentions and choices are rational. For example, this allows for the effects of religiosity encouraging people to have high fertility as they believe a higher power will provide for them if needed.

REPRODUCTIVE AUTONOMY

Newson et al (2007) used vignettes to test whether someone playing the role of a woman's mother or friend is more likely to advise that woman to have a

child in an easy/difficult situation (easy: supportive husband, enough money vs. difficult: single mother/widow); in a normal/deviant situation (normal: widow vs. deviant: single mother); when the woman is younger or older (early 20s vs. early 30s). The answer actually given to the woman is another dependent variable; as is the participant's personal opinion on whether the woman should have a baby. In terms of the participant's personal opinion, those playing the mother were less likely to endorse pregnancy in a difficult situation than those playing the friend; and when the situation was easy were more likely than those playing friends to endorse pregnancy. Whether the participant was playing a mother or friend did not generally affect the actual advice she gave, however. If the participant was actually a mother herself she was less likely to hold the belief that the woman should get pregnant. Participants were less likely to take the age of woman into account if woman was in 'difficult' situation. In 'easy' situations, Ps more likely to endorse pregnancy if woman in her 30s than if she is in her 20s. They also favoured pregnancy more in the 'normal' widow situation than in the single mother ('deviant') situation. Results are discussed in the light of the kin influence hypothesis. Greater female reproductive autonomy is also associated with greater ability and acceptance of women in the work force. Straits (1985) found, through hypothetical vignettes, that women's long-term fertility decisions were dominated by their employment opportunities, and that fertility changes due to inter-cohort shifts in values and expectations of women. The *Theory of Planned Behaviour* considers individual perceptions of and actual ability to control having a child (Ajzen and Klobas, 2013; Philipov et al, 2009 and 2011). Lainiala and Miettinen (2014), and Inoue et al (2013), suggest that skewed sex ratios affect power in relationships, such that in female-biased populations women have less power (see *Sex Ratios*). Reproductive autonomy is also addressed in the *Contraceptive Use and Sexual Coercion* literature. A number of studies found favouring traditional female gender roles (i.e. motherhood over career) increased fertility desires in men and women (e.g. Adair, 2013, Brase and Brase, 2012; Marshall and Shepherd (unpublished); and Philipov et al, 2009).

RESOURCE STRESS/LIMITATION

Griskevicius et al (2011a and 2011b) found no effect of current SES on attitudes towards reproduction, but strong effects of childhood resource stress and associated dispositional life history strategy. Van der Wal et al (2013) found that humans have a natural affiliation to nature/living things. When cued to a natural environment resources were perceived to be plentiful and competition low, while in urban environment resources were perceived to be scarce and competition high. The natural environment thus encouraged a slower life history strategy, and the urban environment a faster life history strategy. Hill et al (2013 and 2014) showed that the life history a person is sensitized to in childhood affects their behaviour in resource stressed environments as adults. Life history strategies appear similar under benign conditions. When cued for environmental harshness (resource scarcity or high mortality (see *Mortality Salience*)) men and women calibrated to fast life history strategy prefer larger women, compared to women and men calibrated to slow life histories (Hill et al 2014) -- women better able to sustain a pregnancy and maternal invest with limited access to resources. Furthermore, fast life history women, when cued for harshness, have increased interest in food and weight gain, and reduced interest in dieting. Slow life history women have reduced interest in food, and increased interest in weight loss and dieting under cues of harsh conditions -- consistent with contingent expression of a slower life history strategy and facilitating delayed reproductive goals through reduced fecundity. A number of vignette studies suggest reproduction in

women with unstable or poor access to resources is disapproved of and/or considered deviant behaviour (e.g. Kushnick (2013) and Newson et al (2007)). Resource stress is also associated with *Mating Preference/Choice*. Cohen and Belsky (2008) showed that under predictably safe conditions women desired a longer-term relationship and valued partners who were sexually faithful, interested in long-term relationships and parental investment more than under the unpredictable safe-risky and predictably risky conditions. Little et al (2007) found that under ecologically harsh conditions men and women favour low-quality/high-investment partners for long-term relationships. For short-term relationships, where investment is unimportant, high-quality partners were favoured regardless of ecological condition. The influence of resource stress on fertility behaviour and attitudes towards women who reproduce under resource poor conditions are also discussed in the *Attachment Fertility Theory*, *Childhood Stress*, *Contraceptive Use*, *Cooperative Breeding/Kin Help*, *Cost of Offspring*, *Cultural Norms*, *Father Absence*, *Life History Theory*, *Parental Investment*, *Partner Insecurity*, and *Sex Ratios* literature. Sex Ratios

Chipman and Morrison (2013) discuss how operational sex ratio (OSR) affects the relative importance of reproductive behaviours, such as mate choice and sexual competition, which can have a knock-on effect to actual fertility scheduling. Male-biased populations favour female mate choice, such that low SES men are less likely to find mates. Female-biased populations favour male mate choice, seen in less stable unions and higher divorce rates, and younger and increased non-marital reproduction in females living in more deprived areas. Found that UK women's responses to female-biased OSR vary by their SES and dispositional life history strategy (LHS) -- high SES women with slow LHS respond to environmental stressors by moving further towards the slow end of the life-history continuum and delaying reproduction, while low SES women with fast LHS seek to have children sooner. Lainiala and Miettinen's (2014) work in Finland supports sex ratios affecting union formation and reproductive timing. Inoue et al's (2013) work in Japan supports female-biased sex ratios being associated with poorer union stability. Inoue et al (2013) also found that female-biased sex ratios are associated with higher rates of spontaneous and artificial abortion, shorter life expectancy, and lower total fertility rates. Lainiala and Miettinen (2014), and Inoue et al (2013), suggest that skewed sex ratios affect power in relationships, such that in female-biased populations women have less power.

Idea – It may be worth investigating the effects of local sex ratio in childhood, and operational sex ratio in adulthood, on fertility desires and intentions. Mate access is a key component of reproductive timing and women's power within relationships, and consequently women's reproductive autonomy and ability to achieve their fertility desires.

SEXUAL COERCION

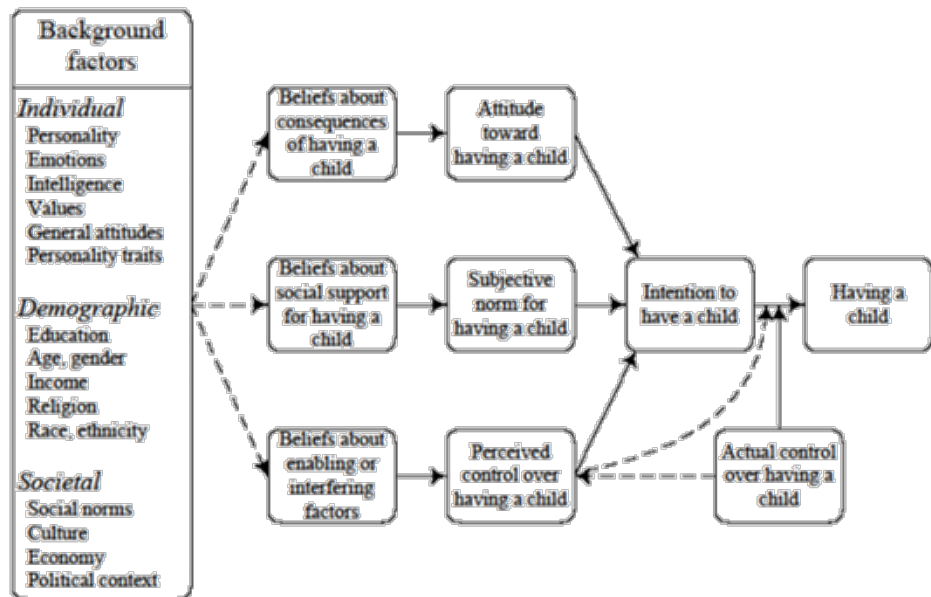
Dunkel and Mathes (2010) found life history theory may help explain men's and women's willingness to sexually coerce a partner. People with high short-term mating preferences and low long-term mating preferences, when cued for increased mortality risk, were more likely to sexually coerce than slow life history (long-term mating preferred) men and women. Dunkel and Mathes (2012), continued their research into sexual coercion with non-experimental methods. They found that sexual victimhood (being a victim of sexual coercion, often in childhood) was positively correlated with perpetration of sexual coercion in both sexes, but more strongly in men. Found life history strategy was associated with sexual perpetration in both sexes, but victimhood

only in males. No evidence of mediation, but evidence of moderation of life history between victimhood and perpetration in females. They suggest that women's reproductive behaviour is more flexible than men's -- plasticity may lead women with fast life history strategies to respond to sexual coercion by incorporating it into their own repertoire of sexual behaviours, while women with slow life history strategies, and fast life history strategy women who have not been victims, do not. Woolf and Maisto (2008) found power inequality within relationships affects the low power partner's ability to initiate contraceptive use, which may be indicative of potential for victimhood. See Contraceptive Use and Reproductive Autonomy.

THEORY OF PLANNED BEHAVIOR

The Theory of Planned Behavior (TPB) has a 4 step pathway (*Figure 3*). People have "Beliefs" about the outcomes of specific behaviors, how others feel about that behavior and whether certain factors affecting the behavior are present. Through evaluation processes these beliefs shape people's "Attitudes" and "Subjective Norms" about a behavior, and "Perceived Degree Of Control" over that behavior. Attitudes, subjective norms and perceived degree of control shape peoples "Intentions" to perform a behavior. These intentions may be modified by people's "Actual Control" over the behavior, but the pathway ends with a "Behavior". TPB has successfully predicted contraceptive use but in general little has been done with it on the measurement and prediction of fertility behaviors. Focusing on contraceptive use does not allow for an understanding of the full continuum of fertility behavior or the shifts in intentions that occur throughout people's reproductive lives. In 2009 TPB was the grounding of a REPRO project. Philipov et al (2009) utilize TPB to address individual level reproductive decision making and how the surrounding macro environment affects this (government policies, economic crises, etc). This is a good introduction to the REPRO project and associated work. Philipov et al (2011), and Ajzen and Klobas (2013), discuss concerns in the application of the theory of planned behaviour to the decision to have a child. For a walkthrough of TPB see Miller (2011b).

Figure 3: From Ajzen and Klobas (2013). Model showing the components of the TPB.



TRANSMISSION COMPETITION HYPOTHESIS

Aarssen & Altman 2012 find in an academic staff and student sample a small inverse correlation between desired fertility and level of interest in goals such as rewarding career, fame and contributing to ideas and discoveries crucially in females but not in males. This is interpreted in the light of the 'transmission competition' hypothesis, where the female drive for genetic transmission is limited in developed countries by the opportunity for 'meme transmission', the latter of which would have been previously satisfied by transmitting cultural ideas via one's offspring. As all participants are highly education this begins to tease out the difference between the influence of education per se, and that of other ambitions.

VALUE OF CHILDREN

This is from the cross-cultural psychology literature investigating the value that adults place on children and how this varies across history, culture and socioeconomic strata. Types of value placed on children cluster into psychological/emotional (e.g. offering the chance to give/receive love); economic/utilitarian (e.g. having someone to contribute economically to the family); and social/normative (e.g. having someone to continue the family name). Kagitcibasi & Ataca 2005 studies changes over 28 years of Turkish history, finding that in general, greater socioeconomic development in time or space means lower utilitarian/economic value attributed to children and the more psychological benefits are emphasised, with a concomitant change in sex preference from boys to girls. Mayer & Trommsdorf 2010 is a 12-nation survey of adolescents, finding an individual-level positive association between the emotional value of children and their fertility intentions, but which is attenuated at higher levels, suggesting that large families are not needed for such benefits.

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**6.2 Appendix B: 'The Evolved Psychological Mechanisms of Fertility
Motivation: Hunting for Causation in a Sea of Correlation'
(submitted to Philosophical Transactions of the Royal Society B)**

**PHILOSOPHICAL
TRANSACTIONS B**

**The Evolved Psychological Mechanisms of Fertility
Motivation: Hunting for Causation in a Sea of Correlation**

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Abstract

Human fertility is, at an ultimate level, a response to three environmental factors: (1) harshness; (2) unpredictability; and (3) resource scarcity. In many populations fertility is below the theoretical maximum given local environmental conditions; and varies more than expected both within and among populations. The physiological mechanisms that influence human fertility are relatively well understood, but do not fully account for observed variations in reproductive behaviour (e.g. age at first birth) or fertility. Proximate mechanisms, such as cultural norms about length of post-partum abstinence and ideal family size, also do not fully explain observed variation. Humans have an unprecedented degree of control over their fertility, and actionable reproductive preferences. A better understanding of the psychological mechanisms underlying human reproductive preferences, in conjunction with an awareness of physiological and culturally imposed restrictions, may be key to understanding human fertility. Here we provide an overview of two environmental factors, harshness and resource scarcity, that likely influence reproductive preferences, and the associated psychological mechanisms. Most work in this area is methodologically limited to showing only correlations of ecological, social and economic factors to fertility decisions. We propose, and support with examples, the use of experimental methods to differentiate causal factors from correlates; and discuss future research directions from a life history theory perspective.

Keywords

Psychological mechanisms, reproductive decision making, reproductive preferences.

Introduction

Life history theory, and correlative evidence, suggests that reproductive timing and investments – important components of life history strategies -- are influenced by three environmental factors: (1) harshness (e.g. age-specific mortality and morbidity rates); (2) unpredictability (e.g. consistency of harshness over time); and (3) resource scarcity (e.g. access to energetic resources, including level of competition for them) (1–5). Life history strategies are the sum of energetic and temporal trade-offs among investment in growth and maintenance, current reproduction, and future reproduction that, in theory, maximize, or at least optimize, biological fitness – often measured as number of surviving offspring (5). Across species, including humans, the influence of harshness, unpredictability and resource scarcity on the underlying physiological mechanisms that regulate life history strategies are relatively well understood (6). For example, women with greater access to resources are more able to meet the energetic requirements of reproduction: They have quicker resumption of post-partum fecundity and, consequently, may have a faster pace of childbearing (7). In humans, however, physiological differences do not fully account for the wide variation in life history strategies seen among and within populations (1,8,9). Across small-scale societies mean age at first birth varies from 16.2 among the Wichi of Argentina to 25.7 among the Gainj of Papua New Guinea (10); and within the United States of America mean age at first birth varied in 2006 from 22.6 in Mississippi to 27.7 in Massachusetts (11). Additionally, evidence indicates that fertility in many human populations is below the theoretical maximum given local environmental conditions and individual physiology (2,12–16). This suggests that in humans reproduction is more than just a physiological process. In fact, humans have an unprecedented degree of control over their reproduction with preferences for age at first birth, length of inter-birth intervals, offspring sex ratio, and completed fertility (17–19). Crucially, reproductive preferences associate strongly with reproductive decisions and fertility (17,20–25). Reproductive decisions, in tandem with physiology, govern human fertility.

The areas in which reproductive preferences are exerted at the individual and population level – proximate determinants of fertility -- are well known (18).

However, despite 80 years of research (27–30), the formation of human reproductive preferences and subsequent reproductive behaviour remains poorly understood. Most research on the relationship between reproductive preferences and fertility has focused on the influence of conditions that are evolutionarily novel

(e.g., formal education level); or characteristics of social groups (e.g. comparing nations by gross domestic product) and average reproductive behaviour of those groups. These approaches can only account for preferences of people facing novel environments, and the focus on group averages is unlikely to explain individual life history strategies. No current research fully accounts for the formation of reproductive preferences or their functional relationship to fertility considering (1) conditions present in deep evolutionary time, and (2) the strategies of individuals, not groups. An under-utilized area of research that is likely to be fruitful here are the psychological mechanisms underlying reproductive preferences.

It has long been postulated that humans have psychological mechanisms that monitor environmental conditions and mediate reproductive preferences and subsequent behaviour alongside physiological mechanisms (31–35). However, the underlying psychological mechanisms of human reproductive decision making and behaviour are rarely studied directly, and, thus, are poorly understood. Consequently, the specific components of harshness, unpredictability and resource scarcity that humans are attuned to, and that influence our reproductive preferences and behaviour, are unknown. This leaves a number of outstanding questions. For example: Are the relationships between these environmental factors and reproductive strategies linear or non-linear? Which environmental factors influence reproductive preferences and fertility the most? How do interactions among environmental factors effect human reproduction? How do humans subjectively perceive environmental factors? How do the effects of environmental factors vary over the life course and in relation to previous experiences? What impact do environmental factors have on the intricacies of life history trade-offs? Providing a clear, straightforward description of how harshness, unpredictability, and resource scarcity affect reproductive preferences would be best achieved via an experimental approach. However, this approach is mired in ethical and legal constraints, and rightly so.

Conversely, relying on natural experiments (e.g., recessions, famine and natural disasters (36– 39)) poses no ethical or legal constraints. However natural experiments are hindered by complexity from simultaneous changes in multiple possible causative factors. This complexity limits explanatory efficacy. To attenuate this limitation, we propose that experimental psychological methods may be useful. These methods allow ethical exploration of individual environmental conditions and their influence on life history strategies, as indicated by selfexpressed reproductive preferences. We are not the first researchers to take this tack: some studies have used psychological methods to explore reproductive preferences. However, it is our opinion that, to date, this research has been limited for two major reasons. One, the specific methods used to understand such psychological mechanisms are generally outside the wheelhouse of most fertility researchers. Two, psychologists trained in these methods rarely focus on reproductive behaviour.

In the present paper, we explore the underlying psychological mechanisms that contribute to reproductive decision making, with a focus on mortality risk (a component of harshness) and resource scarcity for brevities sake. We first review the current literature on the effects of harshness and resource scarcity on reproductive preferences and behaviour, including correlative evidence from large scale projects and natural experiments. We then discuss the strengths and weaknesses of this literature, the uses and benefits of incorporating experimental psychology methods into our research repertoires, and the emerging experimental work on the relationships among mortality rate, resource scarcity and reproduction. We end with a brief discussion on the role of individual personality differences in determining reproductive preferences and behaviour.

Life History Theory

Given finite time, limited budgets, and the basic tenet that energy used for one purpose cannot be used for another, individuals must make complex trade-offs among investment in their own growth and maintenance, their current reproduction, and any future reproduction. Trade-offs vary as a function of individual characteristics (e.g. genetic quality and embodied capital) and as a function of environmental conditions (e.g. harshness, unpredictability and resource scarcity) (40).

Collectively, how an individual manages the trade-offs that allocate energy and dictate the timing of development constitute the individual's life history strategy. Because an individual's characteristics and their environmental conditions are idiosyncratic, life histories will vary along a continuum. On one end, slow life history strategies are characterized by greater somatic investment, delayed sexual development, delayed and reduced reproduction, and heavy investment in offspring. On the other end of the continuum, fast life histories are characterized by less somatic investment, accelerated sexual development and reproduction, higher fertility, and lower investment in offspring. Ancestral environments determine the species-specific position on the life history continuum. Prenatal, childhood, immediate and predicted environments then fine tune an individual's position on the continuum relative to peers (see Coall et al within this volume). In other words, life history strategies are facultative – determined by our childhood environments toward relatively fast or slow trajectories, but likely to remain pliable in the face of new information.

Death and babies

The relationships among mortality risk, resource scarcity, and individual growth, maintenance and reproduction are complex, interconnected and bidirectional (e.g. high mortality risk is commonly associated with resource poor environments, which may have confounding effects on reproduction) (41). Within and among species, high extrinsic mortality rates predict faster life history strategies and low extrinsic mortality rates predict slower life history strategies (5). When extrinsic mortality is high, earlier reproduction reduces mortality exposure over time and extends the reproductive lifespan (42). This increases fertility and reproductive success by buffering against the high rate of offspring mortality. When extrinsic mortality is low, differential reproductive success is contingent on resources invested in growth, reproduction and parenting effort: In low extrinsic mortality environments individual fitness is enhanced by delayed reproduction, allowing for greater investment in self and resource accrument, and lower fertility combined with greater investment per offspring.

Research on the relationship between mortality and reproduction is confounded by difficulties differentiating between intrinsic and extrinsic mortality components, which can have profound and diverging influences on adaptive behaviour (39). Extrinsic mortality is the age specific mortality risk shared equally by all members of the population independent of individual trade-offs in investment in self versus reproduction (43). Intrinsic mortality is the risk of dying contingent on an individual's condition – a product of individual resource access and allocation of resources to somatic investment. Because any age-specific mortality rate has both extrinsic and intrinsic components that can be difficult to partition; most studies use “all-cause” mortality rates or, alternatively, strong correlates of these (e.g., life expectancy at birth, infant mortality rate) (42).

The relationship between mortality and reproduction is seen both within and among populations. In humans, those with shorter life expectancies on average are younger at reproductive maturity, younger at first birth (10,44–47), and have larger family sizes than those with longer life expectancies (48–50). High infant mortality is associated with earlier ages at first birth, shorter inter-birth intervals (especially following an infant death), reduced parental investment, and higher fertility (51). However, at very high rates of infant mortality, a saturation point of parental investment is achieved that delays reproduction, thus lowering fertility(50). It is also known that earlier ages at first birth and shorter inter-birth intervals are risk factors for infant mortality (41,51–53). This generalization of mortality risk and observable bidirectionality, coupled with the strong correlation between resource scarcity and mortality risk, make it a challenge to unravel the specific elements of the environment humans monitor when developing their life history strategies.

Childhood exposure to high extrinsic mortality predicts faster life history strategies: younger age at first birth, intensified reproductive scheduling, and lower parental investment (45,46,50,54–57). Conversely, childhood exposure to low extrinsic mortality -- commonly associated with higher costs and future payoffs to investing in children -- is associated with delayed and reduced reproduction (45). However, research on the effects of childhood exposure to differing extrinsic mortality risks is confounded by correlation between

mortality and resource scarcity. As such, it sheds little light on the specific mortality cues we are attuned to, or the underlying mechanisms of response that encourage faster or slower life history strategies and corresponding reproductive behaviour.

There is evidence that we are attuned to sibling deaths (58), and more generally to the deaths of people we feel close to (bereavements) (59). High sibling mortality is associated with earlier marriage and first birth (i.e. a faster life history strategy) among historic populations in Germany, Finland, and Canada, despite different subsistence levels (58). However, family-level exposure to mortality (any sibling deaths at any time) was found to be more important than the individual's own exposure (only sibling deaths after the individual was born). Here, children may be unable to directly perceive mortality risk, instead responding to changes in their family members' behaviours and in the subsequent rearing environment (1,55,58). In general, deaths of people with whom an individual is close are associated with earlier preferred age at first birth, and an increased hazard of first birth at any given age (59). However, as with sibling deaths, individuals with more bereavements may live in harsher, more unpredictable, or resource-scarce environments, and be attending to cues unrelated to the deaths themselves.

A number of natural experiments also shed light on what aspects of mortality humans monitor, thus suggesting that current environmental conditions affect life history strategies. Fertility increases following natural disasters, economic crises, terrorist attacks, war and genocide are well documented (60–64). One study found that there was a mini baby boom in response to the Oklahoma City bombing of 1995; The effects were strongest in the geographical areas closest to the bombing (38). Another study showed fertility increases after the 2004 Indian Ocean tsunami. In the communities where tsunami-related mortality rates were high, women who were nulligravid before the tsunami conceived sooner than nulligravid women in communities with few fatalities (39). Similarly, a study on the 1989 Hurricane Hugo found that marriage and birth rates increased in the 24 South Carolina counties that were declared disaster areas, but not in the 22 control counties in the same state (65). In each of these cases, however, multiple factors were affected (e.g. mortality, morbidity, resource scarcity, distribution of

kin), and it is impossible to truly partition the effect of any one factor, to isolate the elements of a factor that are important, and to describe the psychological mechanisms linking the environment and reproduction.

Resources and babies

As mentioned above, mortality risk correlates with resource scarcity, and intrinsic mortality risk is directly affected by resource access. Moreover, resources scarcity predicts variation in life history strategies in several ways. Individuals with fewer resources are usually less healthy and less robust. Resource scarcity affects parents' ability to invest in their offspring; reduced parental investment also negatively affects offspring survival and possibly offspring reproductive success (19,16,66). The effects of resource scarcity on life history strategies are, however, complex. Among traditional human societies, there is a negative relationship between resource scarcity and fertility (67–69). Conversely, in developed countries, resource scarcity is positively associated with both fertility preferences and total fertility. The relationship between resource scarcity and fertility is further complicated by the fact that, in developed countries, within smaller and more similar social groups (e.g. social classes) resource scarcity and fertility are still negatively associated (28,29,68). However, this research is largely correlative and it is difficult to partition environmental cues, or speak to the underlying psychological mechanisms linking resource scarcity and reproductive behaviours.

There is considerable evidence from post-demographic transition societies that paternal absence is a specific environmental cue that promotes faster life histories in women, including younger ages at menarche and first birth, and greater sexual risk taking (55–57). Although, the effects of paternal absence may be culturally novel and related more to its effects on resource scarcity, and changes in maternal investment and parenting strategy. Humans are cooperative breeders: We are highly dependent on extended kin networks for ensuring relatively continually resource access, help with childrearing and environmental buffering (70,71). Among the Tsimane, Bolivian forager-farmers, the effect of paternal absence is minimal and likely limited through provisioning and care by

maternal kin (72). There is mixed support for paternal absence predicting negative effects on child wellbeing within other indigenous groups (73–76). In developed countries, the provisioning, rearing and buffering unit has shrunk to the nuclear family, potentially allowing father absence to have more profound effects on resource scarcity and the stress of the rearing environment (14). Although there is consistency of association with this cue, how paternal absence changes the rearing environment and what specific environmental factors are being conveyed by father absence that influence adult reproductive behaviour remain unclear.

The influence resource scarcity has on fertility has been examined in a number of studies using naturally occurring changes in resource availability. For example, the fertility outcomes of the Great Chinese Famine of 1958-1961 have been well studied. At the peak of the famine, the Chinese total fertility rate decreased to a low of 3.29. Many women reported famine-related amenorrhea, and people postponed marriages, increased their use of contraception, and reported having intercourse less often. This was followed by a post-famine baby boom, with the total fertility rate peaking at 7.50 (77). The fertility outcomes of economic recessions have also been studied (37). The impact of economic hardship on fertility has been found to vary with factors such as sex, age, socioeconomic status, and number of existing children. The most pronounced recession effects on fertility are seen in childless young adults who severely delay the onset of their childbearing. Young adults are disproportionately affected by unemployment and job instability during recessions: They are more likely to face resource scarcity or unpredictable resource availability. Again, these natural experiments lack information specifically about causal pathways - - multiple factors known to influence fertility were affected – and, thus, the underlying psychological mechanisms are obscured.

The aforementioned studies have been useful, highlighting environmental factors that correlate with reproductive preferences and behaviours. They suggest general environmental conditions that humans may monitor. However, these studies can only hint at causal relationships. The natural experiments have made inroads and their external validity is noteworthy. Yet, in natural experiments, multiple environmental factors change simultaneously (e.g.

mortality, morbidity, resource scarcity, and distribution of kin), making it difficult to partition the effect of any one factor, to determine its explicit components, and describe the associated underlying psychological mechanisms.

Psychological Mechanisms Underlying Reproductive Behaviour

The psychological mechanisms underlying reproductive decisions are surprisingly under researched and constitute a large gap in understanding of human reproduction. There are several theories suggesting how psychological mechanisms influence reproductive behaviour (see (78) for a review). To generalize, these theories suggest that environmental conditions that affect reproduction are monitored, resultant information is internalized, and strategies that increase reproductive success are manifested as reproductive preferences. These preferences are further adjusted by cultural reproductive norms, perceived familial and partner expectations, ongoing environmental changes, and past experiences; ultimately, these adjusted preferences become reproductive intentions. These intentions influence contraceptive or proceptive behaviour; coupled with a receptive partner and a suitable environment, intentions lead to reproductive events. However, support for these theories are typically correlative and can only loosely address the specific environmental conditions and their effects on reproductive preferences and behaviour (34,78). More in-depth studies are needed to describe the nature of the psychological mechanisms influencing reproductive preferences and behaviours; experimental methods are well-suited to this task.

Experimental Methods

There is an increasing call for the use of experimental methods in the social sciences (80– 82). Experimental methods are used to isolate causal factors by running an experiment many times with only one variant. If the results change with the variant then that variant is likely the cause. In chemistry, physics, and biology it is relatively easy to create situations where all possible casual factors can be controlled and replicate them multiple times. Concerns about the use of

experimental methods to study human behaviour – given its complexity and the difficulty of conducting experiments in field settings where it is harder to control variables – have created a need for sophisticated methodologies. Thus, experimental design in settings with irregular and non-predictable variation (i.e. naturalistic settings with humans) has been increasingly addressed and supported by statistical theory and application (80).

Experimental methods have been present in economics research since the 1940s, though from 2000 to 2008 only about 4.15% of published papers used laboratory experimental methods (79). Political science and some subdisciplines of psychology were also early adopters of experimental methods, but in general uptake has been slow, resisted, and critiqued among most of the social sciences. The resistance to experimental methods stems from beliefs that experiments, especially laboratory based experiments, lack realism, generalizability, and replicability, compared to traditional methods, such as demographic surveys and natural observations (79–81).

The concern regarding low realism in experimental methods –which is particularly apparent in laboratory based experiments – may be outweighed by the benefits of being able to isolate causal effects. Traditional demographic and anthropological methods can only isolate causal effects when the relationships are linear, a situation that may be rare. Additionally, experimental methods provide controlled variation, allowing for the manipulation of environments in a way that is hard to duplicate in naturalistic settings (79). Experimental methods can also provide high internal validity (80); however, they have potentially low external validity compared to traditional field methods. Taking experimental methods to field settings, as many behavioural economists do (82), can be useful: they can provide high external validity providing, cultural and educational differences are addressed; reduce critiques regarding realism; and increase the generalizability of findings. For example, field experiments with factorial designs with vignettes embedded alongside standard survey instruments have proven quite successful (83).

Field experiments encourage movement to new populations and environments, which can lend additional insight. While research using experimental methods is often based within university populations that arguably are WEIRD (white,

educated, industrialized, rich, and democratic) and have limited experience with many of the behaviours of interest (84), using university populations is valid if piloting new methods, assuming human universals, or if predictions are independent of assumptions concerning the subject pool. Increasingly, experimental methods are being used with non-University populations (85–88), populations with specific and relevant experience (89,90), and with populations in developing countries and in more traditional field settings (83,91). These studies extend the application of experimental methods and have been somewhat successful in addressing the causal pathways that underlie reproductive decision making. However, these studies are hindered by smaller sample sizes than typical survey data making generalizations difficult due to lack of formal weighting systems.

Experimental Methods with Non-humans

A myriad of experiments have demonstrated the importance of extrinsic mortality risk on reproductive timing in non-human animals. For example, an experiment using fruit flies (*Drosophila melanogaster*) has shown that higher extrinsic mortality rates lead to shorter lifespans and earlier peak fecundity (92). A similar experiment using nematodes (*Caenorhabditis remanei*) showed that females from high-mortality populations had more offspring (93). Meanwhile, a long-term field experiment in which guppy-predator populations were manipulated over an 11-year period, showed that higher predation caused the guppies (*Poecilia reticulata*) to evolve, over multiple generations, towards earlier maturation, higher reproductive effort and more, but smaller, offspring (90).

Evidence for effects of extrinsic mortality risk on reproductive strategies in longer-lived animals tends to be correlational, rather than experimental. However, there is a large literature suggesting that similar patterns exist across species (5). For example, a seminal paper showed that mammals facing high mortality rates tend to mature early and have larger litters of smaller offspring, with shorter gestation periods (4). The few experimental studies that have been conducted with birds and mammals further support this relationship between mortality risk and reproductive strategies. For example, Siberian jays (*Perisoreus infaustus*), when exposed to cues of nest predators, choose better protected nest sites and reduced their clutch size (95). Experiments have also investigated the

effects of resource scarcity, specifically manipulation of food availability, on reproductive strategies in non-human animals. Among female guppies increased food availability led to increased numbers of offspring, while decreased food availability led to a delay between broods, allowing the females to accrue more resources (96). A recent meta-analysis of studies among birds showed that in most cases food supplementation encouraged earlier laying dates and increased clutch size (62); although a metaanalysis among small mammals found only a weak effect of food supplementation on reproduction (97). Further, facultative reproductive responses to resource availability may be moderated by obligate trade-offs with immune function and other factors. Among Texas field crickets (*Gryllus texensis*), food availability is positively associated with fecundity, fertility and hatchling size (98). However, when the crickets were immune-challenged, independent of food availability, obligate reproduction-immunity trade-offs limited the number of offspring produced.

It is important to note that many of the experiments outlined above suggests that the organisms facultatively adjust their life history strategies within their lifetimes, based on environmental conditions, such as resource scarcity and extrinsic mortality risk. Humans would likely respond similarly to experimental manipulation of their environments.

Experimental Methods with Humans

Experimental work in psychology has shown that manipulating perceptions of ecological contexts can impact a wide-variety of behaviours including those related to reproduction. Indeed, psychologists have long known that altering perceptions of the environment, through hypothetical scenarios or unconscious manipulation, can have predictable impacts on decisionmaking, motivations, and behaviour (99).

Experimental studies using hypothetical vignettes to manipulate ecological settings have shown how environmental cues consciously shape decision-making related to reproduction, including factors that influence maternal care (83), women's fertility aspirations (100), how power within a relationship affects contraceptive use (101), and how maternal kin and peers vary in their preferences for hypothetical women's reproductive behaviour (91). While vignettes are

useful for studying how ecological contexts shape conscious decision-making, these studies typically have low external validity, with empirical support for a tight concordance between hypothetical and actual behaviour reported in only a few, highly specific domains (102). In addition, it is difficult to control the content of vignettes with any great degree of specificity. Often vignettes differ on a range of dimensions, including that which is hypothesized to have an effect. Unless the vignettes are extremely well written, such that they are similar in all ways bar one element of interest, they suffer a similar problem to natural experiments – multiple factors may be varying simultaneously.

Priming studies are better suited than vignettes to study unconscious influences on decision-making and motivation. Priming has a rich history in psychology and scientific value as a key experimental method for understanding human behaviour (80,99) . Priming involves an implicit memory effect whereby exposure to one stimulus influences reactions to another. The long history of observed robust effects has earned a key place in psychologist's tool-kit, however priming studies have been criticized due to the inability of researchers to clearly explain how and why they work, and the host of second generation problems related to extending the effects outside of controlled laboratory settings (99).

Evolutionary Psychology and Priming Experiments: Evolutionary psychologists have aimed to answer the question of why priming works. They propose that we have evolved cognitive machinery that has been shaped by natural selection to solve adaptive problems. These mechanisms produce adaptive behaviour by first tracking information about the environment to generate a perception. Perception itself is the organization and interpretation of information to represent and understand the external world. Some evolutionary psychologists have argued that the ultimate function of perceptions is to guide facultative behaviours (103). Perceptions guide the selection of behavioural strategies that would be optimal in the perceived environment. Priming directly manipulates these perceptions altering the selection of behavioural strategies. The frame problem suggests that perception is not a blank slate but guided and directed to key elements of the environment that are adaptively significant (see (104) for definition and discussion of the frame problem). Indeed the correlational studies of human

fertility suggest that perceptions of mortality salience, resource scarcity and unpredictability, and other key ecological features are likely to impact reproductive decision-making and motivations.

Mortality Risk: There is substantial evidence that encouraging people to think about death (i.e. using a mortality prime) increases childbearing motivation. As discussed previously, mortality is a crucial environmental cue in life history theory. Mortality salience is also a primary cue suggested by Terror Management Theory (TMT) that reliably impacts reproductive preferences. TMT proposes that humans face a unique psychological conflict: We desire to live but realize the inevitability of death, which induces terror that we alleviate by ensuring immortality through cultural (e.g. belief in an after-life) and biological (e.g. reproducing) means. Research in the TMT framework has shown greater pro-offspring sentiments and behaviours among German and Chinese undergraduates exposed to mortality primes when compared to control groups (88,105). Further work in China has shown people primed with mortality were found to be more disapproving of the one-child policy than controls (106). Evidence of sex differences in the effect mortality salience has on the desired number of offspring have also been reported, with men showing larger effect sizes (107). When women were primed with information that suggested childrearing and careers were compatible, they wanted more offspring in the mortality salience condition, a similar result to that which was found for men.

Priming experiments in the life history theory framework have also reported sex differences in the effects of mortality salience on reproductive preferences. Exposure to cues of high mortality risk encouraged desire for childbearing, and larger ideal family size in men, but not women (108). These effects have been similarly interpreted as a reflection of the greater opportunity costs for women associated with reproduction. However, recent priming studies using a life history perspective have relied on a more nuanced explanation of these contextual effects by stressing the importance of developmental effects on dispositional life history strategies (109–111). The argument is that developmental contexts shape the suite of facultative behavioural strategies available as an adult (40,112); an argument that has received some empirical support in correlational studies (113). Using hypothetical vignettes, it has been

found that manipulated life expectancy interacted with dispositional life history strategies to predict willingness to engage in sexual coercion (111). Consistent with this, priming methods have found the effect of mortality salience depended on childhood environments, with individuals growing up in relatively resource scarce environments shifted towards a desire for earlier reproduction, while those reared in resource rich environments shifted toward delayed reproduction after exposure to a mortality prime (110).

This same interaction effect has been found in other domains not related to reproduction (114,115), as well as those domains that are indirectly related to reproduction such as risk-taking and temporal discounting (109). For example, when childhood environment and current environmental conditions each promote faster life history strategies, this convergence encourages a preference for a heavier female body size in both men and women (114). Indeed, temporal discounting and risk-taking are behavioural components associated with variation in human life history strategies (116) and have been shown to follow predictable associations with actual reproductive outcomes (117). The evidence reviewed above shows that mortality salience can affect not only reproductive motivations but also individual differences in temporal discounting and risk-taking behaviours, and that these effects might vary according to the developmental environment.

Resource Scarcity: The LHT framework also predicts perceptions of resource abundance and access are important determinants of reproductive behaviour. Recent priming studies using cues of resource abundance have shown shifts in temporal discounting and risk-taking that are consistent with the LHT framework (90,118). Priming cues of poverty among Chinese undergrads lead to higher preferences for short-term rewards when compared to those primed with cues of affluence (23). Moreover, primes of natural environments, presumably more resource rich, reduced temporal discount rates compared to resource barren urban environments (24). The effects of perceived resource stress and abundance have also been shown to affect motivations and preferences directly related to reproduction. Research has shown that exposure to cues of resource stress and uncertainty affect mate choice and mating strategies by shifting preferences for earlier reproduction and selection of mates more suitable

for short-term mating (87,119). Exposure to primes of resource scarcity have also been associated with intentions to delay reproduction, even among those with a characteristically fast life history strategy (120).

Priming studies have also addressed paternal absence. Women exposed to cues of paternal absence exhibited greater sexual risk-taking than women exposed to cues of paternal presence (121). These effects were specific to women's sexual risk taking, and did not influence women's non-sexual risk taking or men's sexual risk taking. Furthermore, only paternal absence had this affect: The absence of a close friend had no effect. If, brief exposure to cues of paternal absence encourage sexual risk taking in women, prolonged paternal absence likely predisposes a woman's psychology toward greater sexual risk taking throughout adulthood and affect her reproduction.

Conclusion

At an ultimate level, mortality risk and resource scarcity influence our life history strategies, including our reproductive preferences and behaviours, through physiological and psychological mechanisms. The physiological mechanisms are relatively well know; however, the psychological mechanisms are under-researched, and have proven difficult to assess, especially in naturalistic settings. It is assumed that humans have evolved psychological mechanisms that perceive environmental factors, internalize them based on previous experiences and future predicted experiences, and subsequently affect reproductive preferences and behaviour. Yet, the research to date has been largely correlative, rarely showing casual pathways and cannot truly illuminate the specific environmental cues and their effects on reproductive preferences and behaviour. Here experimental methods, which have so enlightened our understanding of environmental factors' influences on reproductive behavior in non-human animals, may prove useful. Most experimental methods employed with non-human animals for legal and moral reasons are not possible with humans. However, experimental psychology methods are temporary and less invasive; and may allow for experimental work with humans that addresses the

underlying psychological mechanisms that influence human reproductive decision making. Emerging research with priming has begun to demonstrate this.

Priming studies have produced good evidence for the existence of psychological mechanisms that link ecological settings to variation in reproductive decision making in humans. These studies are forerunners in an emerging field; however, studies to date have had several limitations. First, subjects are typically from WEIRD populations (84) who also tend to have low population fertility rates. Future work should extend priming studies of fertility preferences to a broader, cross-cultural context, particularly with populations who have yet to complete the demographic transition. This will help address questions about the universality of the psychological mechanisms influencing human reproductive decision making and the environmental cues we are attuned to.

Second, despite partitioning mortality risk and resource scarcity, priming studies to date have not been specific enough to address what components of these environmental cues we are attuned to. A notable exception being a study on the effects of paternal absence on sexual risk taking (121), in which just thinking about an important time in their lives when their fathers were absent was found to encourage sexual risk taking in women. Future work should aim for greater specificity of the environmental component being primed, e.g. sibling deaths or infant mortality. Future work could also address the linearity of relationships between environmental cues and reproductive decision making; and how interactions between environmental cues affect reproductive decision making. For example, is the negative association between mortality risk and age at first birth linear or must a threshold mortality risk be exceeded before humans shift their reproductive preferences? And, under conditions of high mortality risk, how does within population variation in access to resources confound the effects of high mortality on human reproductive preferences?

Third, most priming studies have used written media to cue mortality risk or resource scarcity. The validity of this, compared to more naturalistic media is questionable (see (90) for an exception utilizing natural environments). Written media also suffers in translation and is inappropriate for work in illiterate populations, making cross-cultural comparisons difficult. Some researchers have begun to employ photographs suggesting higher mortality risk or resource

scarcity (90,115). However, the cross-cultural validity of the image content is disputable. Other researchers have utilized pre-questions to prime mortality risk (108): Subjects were asked questions about their perceptions of local mortality risk before answering questions about their reproductive preferences. However, these stated perceptions are likely influenced by conscious decision pathways and cultural norms. Future work should aim to develop primes that have strong cross-cultural validity and discover if we perceive different environmental components through different mechanisms. For example, does word of mouth (e.g. written media) best cue mortality risk, while resource scarcity is best cued by more personal experiences (e.g. recalling childhood events)? And, how does the source of the cue affect our perceptions of its gravity and the weight given to it?

Fourth, with psychological experiments we are limited to altering individual's perceptions of their environment and measuring their preferences: Their realities remain unchanged and their future realized reproductive behaviour unknown. Nevertheless, these methods can be effective and enlightening. Perceptions of mortality risk and resource scarcity are known to affect life history strategies (55), and may be more influential than reality in some instances (122). Preferences are strongly linked to intentions which in turn are positively associated with behaviours (17,20–25). Furthermore, if our underlying goal is to piece together how the psychological mechanisms influencing our reproductive decision making function, the key is understanding how humans perceive and internalize their reality, which subsequently affects their reproductive preferences and behaviour.

Fifth, although some priming research has acknowledged that childhood environment likely initiates changes in individual psychology that moderate responses to cues of current environmental harshness in adulthood, the pathways for this remain poorly addressed. One avenue through which childhood environment may influence life history strategies, and responses in adulthood to varying environmental conditions, is personality. Individual variation in personality may represent different adaptive strategies with the same reproductive and survival-related goals. Possible origins for personality as part of an adaptive strategy include: sexual selection (123); frequency- or niche-

dependent selection; fluctuating selection leading to heritable variation in calibration (124); situationally activated alternative strategies(125); and developmental calibration (126). The life history trade-offs associated with different levels of a trait and possible co-evolution between personality and life history strategy have also been emphasized (127–130)

Different personality dimensions appear to be differentially correlated with lifetime reproductive success (129,130), though most human research may only indicate current adaptive optima in post-demographic transition societies, where contraception complicates matters. Extraversion (typified by activity, sociability, and dominance) generally positively predicts fertility (131), and in Senegalese males also strongly predicted high social class and polygyny (130). However, highly extraverted British men also suffered more hospitalizations from accident and illness (128), a survival trade-off echoed in non-humans (129). Conscientiousness seems to decrease fertility, for example in Norwegian women across 40 years of data (131) and in British panel data conscientious women postponed childbearing (132). In Finnish data the association increased in later cohorts and in both sexes (133). Openness to Experience (intellect; creativity) was negatively related to fertility in British women partly because it positively predicted educational uptake and fertility postponement (132). This has been echoed in males (132) and increasingly in younger birth cohorts for both sexes (133), though inconsistently (134). Agreeableness (cooperativeness; empathy) predicts higher fertility at least in females (133), also including reproductive acceleration (132). Neuroticism has the most complex relationship to fertility. It may predict more short-term mating (135) or accelerate childbirth (132); yet has been found to depress fertility altogether (134). In Senegal (130) neurotic women had more children, but if low-status had poorer quality offspring, perhaps indicating a trade-off. Personality is likely to act on fertility via a number of routes, including aiding mate retention (136); likelihood of consistent contraceptive use (32); and influencing subjective norms and perceived behavioural control (137). Future research would benefit from investigating how different personalities, alongside, and independently, of more traditional measures of childhood environment (e.g. childhood socioeconomic status or age at menarche) influence adult life history strategies, including reproductive preferences.

In short, experimental work using priming may be the shining light in research on human reproductive decision making; and will likely separate the causal pathways, and their associated environmental cues, from the sea of correlative evidence. However, more research and methodological fine tuning is needed.

Authors' contributions

LM conceived of this review and drafted the manuscript. GP helped draft the section Experimental Methods with Non-Humans and contributed text on natural experiments. JH helped draft the section Experimental Methods with Humans. SV drafted the section in the conclusion on personality. DC and KS provided considerable intellectual input and editing. All authors gave final approval for publication.

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6.3 Appendix C: Construction of dataset for Chapter 2's geographical analysis

How wards of different types were merged:

Wards were the geographical unit of analysis. However, in terms of available variables, there is more than one type of ward: Census Area Statistics (CAS) wards, 2003 wards, and Standard Table (ST) wards. This is due to the smaller 2003 or CAS wards in some cases having been merged into the larger ST wards to aid confidentiality. In the main, nevertheless, the different ward types describe the same geographical entities. As the main independent variable, life expectancy, was only available at ST ward level, this ward type dictated the initial N. Then exclusions were made where Office for National Statistics information indicated that mergers had made wards with the same ID numbers non-identical. For further information, see <http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/administrative/england/electoral-wards-divisions/statistical-wards--cas-wards-and-st-wards/index.html>.

Variables used in the analysis in Chapter Two

VARIABLE	SOURCE AND TYPE OF WARD, TIME PERIOD MEASURED	COMMENTS
INDEPENDENT VARIABLES		
MORTALITY MEASURE		
Life Expectancy	Office for National Statistics ('experimental' data) Standard Table ward 1999-2003	Constructed from abridged life tables. Average number of years a newborn baby would survive if he or she experienced the ward's age-specific mortality rates for that time period throughout his or her life. Aggregated 1999-2003.
MORBIDITY MEASURE		
Age-standardised long-term limiting illness prevalence (LTLI)	Census 2001 Census Area Statistics ward April 2001, referring to previous 12 months	Derived from prevalence of long-term limiting illness in population and multiplied by proportion of individuals in that age band in England & Wales in 2001. Age-specific totals then summed. Expressed as a proportion between 0 and 1.
DEPENDENT VARIABLES		
'Abortion proportion' for age bands: under 25, 25-29, 30-34, 35 and over, all ages	Office for National Statistics CAS wards 1999-2003	Proportion of conceptions ending in abortion
COVARIATES		
Proportion of persons living in Medical and Care establishments NB: used only in models featuring Life Expectancy as independent variable	Office for National Statistics ('experimental' data) Standard Table ward 1999-2003	Categorical variable in quintiles ranging from 0 (none) to 5 (many)
Urban/rural	Office for National Statistics CAS ward March 2004	Dummy variable with three settlement types: 1= urban ward with population greater than 10K 2= 'town and fringe' ward 3= villages, hamlets and isolated dwellings Reference category: 1
proportion of people aged 16 to 74 with level 4 and 5 qualifications (e.g. first degree; higher degree; NVQ levels 4 and 5; HNC; HND; Qualified Teacher Status; Qualified Medical Doctor; Qualified Dentist; Qualified Nurse; Midwife; Health Visitor)	Census 2001 CAS ward April 2001	Index of educational level across all age groups in an area, which meant it would be meaningful for all age groups of the 'abortion proportion' dependent variable. Arguably an index of expectations regarding educational attainment in an area.
Proportion of people aged 18 to 64 claiming Jobseekers' Allowance	Department for Work and Pensions 2003 ward 'snapshot' data, August 2001	Used in preference to an index of unemployment, as those not only unemployed but also claiming unemployment benefits will also be impoverished rather than simply choosing not to work.
Average weekly household net income estimate equivalised after housing costs	Office for National Statistics 2003 ward	Household income with household size and local housing costs adjusted for to

VARIABLE	SOURCE AND TYPE OF WARD, TIME PERIOD MEASURED	COMMENTS
	1st April 2001 to 31 st March 2002	create a proxy measure of individual welfare. Model-based estimate combining survey data with census and administrative data.
Proportion of people of each type of housing tenure (owner-occupied, social rented housing, privately rented housing, rent-free)	Census 2001 CAS ward April 2001	
Proportion of people of each different religion or none/not stated	Census 2001 CAS ward April 2001	
Proportion of people of each different ethnicity	Census 2001 CAS ward April 2001	

**6.4 Appendix D: Questionnaire for Chapter 3's Mortality/Longevity
Salience Experiment**

APPENDIX C: MORTALITY/LONGEVITY SALIENCE QUESTIONNAIRE

SCREENER QUESTIONS

SEX

What sex are you? *

* Male

* Female

What age group are you in? *

Please select your age in years from the categories below.

* Under 18

* 18-25

* 25-34

* 35 and over

What is your exact age? *

Please choose your exact age in years from the options below

* 18

* 19

* 20

* 21

* 22

* 23

* 24

* 25

What country do you currently live in? *

* England

* Wales

* Other

Where did you live up to age 18? *

* England

* Wales

* Other

Are you married? *

* Yes

* No

Are you living with a romantic partner? *

* Yes

* No

Do you have any children? *

* Yes

* No

Has someone close to you recently died? *

* Yes

* No

Are you suffering from a life-threatening illness? *

* Yes

* No

Are you pregnant or do you think you might be? *

* Yes

* No

Have you recently been pregnant? *

* Yes

* No

Do you have a romantic partner who is pregnant or thinks she might be? *

* Yes

* No

Do you have a romantic partner who has recently been pregnant? *

* Yes

* No

MORTALITY SALIENCE CONDITION

For the following quiz, simply answer each question the best you can.

For many of the questions there is no right or wrong answer.

1. How many people do you think died in transport accidents in England and Wales in 2011?
* Around 2000
* Around 3000
* Around 5000

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. Below is a list of some of the different ways that people died in England and Wales in 2011. Please type the LETTER of the one you think is
1) MOST common
2) LEAST common
A. falls
B. fire
C. vehicle accidents
D. murder
E. drowning
F. poisoning
G. electrocution
3. Compared with your friends and family, how upset do you get when death is shown in the media (e.g. films, TV, books, newspapers)?

Much less upset than them ***** Much more upset than them
4. How frequently do you think about death?

Every day ***** Never
5. At any point in your life, have you ever felt that you were about to die?
* Yes
* No
6. If it were possible, would you want to know the exact date you were going to die?
Yes
No
7. In the past, have you experienced the death of a close friend or family member?
Yes
No

If yes, how old were they at the time of their death
8. Some people worry at the thought of their own death. Does the thought of your death ever cause you concern?
9. Where do you think you will be when you die?

10. Some people believe that death is a doorway to a new type of existence. Do you personally believe in 'life after death'?

LONGEVITY SALIENCE CONDITION

For the following quiz, simply answer each question the best you can.

For many of the questions there is no right or wrong answer.

1. In England & Wales in 2011 average life expectancy increased compared to the year before. By how many months do you think it increased?
 - * Around two months
 - * Around three months
 - * Around five months

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. Each of the following things has been found to increase life expectancy in England & Wales. Please type the LETTER of the one you think
 - 1) increases life expectancy the MOST
 - 2) increases life expectancy the LEAST
 - A. Eating a mostly vegetarian diet
 - B. Moderate alcohol consumption
 - C. Belonging to a community
 - D. Regular moderate exercise
 - E. Meditation/prayer
 - F. Having positive friends
 - G. Putting family first
3. Compared with your friends and family, how far are you interested in media stories about people who have become healthier and fitter?

Much less interested than them ***** Much more interested than them
4. How frequently do you think about yourself in the future as a retired person?

Every day ***** Never
5. Have you ever read or heard about research into ways of making humans live longer?
 - * Yes
 - * No
6. With life expectancy rising, the age of retirement will change. If it were possible, would you want to know the exact date of your retirement?
 - * Yes
 - * No
7. In the past, have you ever become friends with someone a lot older than you?
 - * Yes
 - * No

If yes, how old were they?
8. Some people plan what they will do in their retirement. Does the thought of being retired make you want to make plans?
9. Where do you think you will spend the last few decades of your life?
10. In some places across the world, some people live beyond 100 years in excellent health, and even take part in activities and sport.

Do you personally foresee doing such things in your old age?

CONTROL: LOST PROPERTY CONDITION

For the following quiz, simply answer each question the best you can.

For many of the questions there is no right or wrong answer.

1. How many items of lost property do you think were handed into Network Rail in the UK in 2011?
 - * Around 2000
 - * Around 3000
 - * Around 5000

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. The items below are all often lost in England and Wales each year.
Please type the LETTER of the one you think
1) is MOST commonly lost
2) is LEAST commonly lost
 - A. gloves
 - B. travel tickets
 - C. wallets/purses
 - D. keys
 - E. mobile phones
 - F. clothing
 - G. umbrellas
3. Compared with your friends and family, how upset do you get when you lose something?
Much less upset than them ***** Much more upset than them
4. How frequently do you lose things?
Every day***** Never
5. At any point in your life have you ever lost an item of property on a train, bus or plane?
 - * Yes
 - * No
6. If it were possible, would you want to know the exact date you were next going to lose something?
 - * Yes
 - * No
7. In the past, have you ever lost something that was very valuable?
 - * Yes
 - * NoIf yes, how much was it worth?
8. Some people find ways to avoid losing things, like always keeping items in the same place.
Does the thought of losing things make you want to use such strategies?
9. Where do you think you will be the next time you lose something?
10. Some people eventually get to a point where they stop losing things.
Do you personally think you will always lose things?

If you would like to further discuss the issues raised in the questions you have just answered, please
email
sandra.virgo@lshtm.ac.uk

Next follow some questions about your attitudes towards abortion.

There are no right or wrong answers so please just give your honest response.

PERSONAL ABORTION APPROVAL QUESTIONS

FOR WOMEN:

If you discovered you were pregnant now, would you have an abortion?

Definitely no 3 2 1 0 1 2 3 Definitely yes

FOR MEN:

If you had a girlfriend who discovered now that she was pregnant by you, do you think she should have an abortion?

Definitely no 3 2 1 0 1 2 3 Definitely yes

EARLY PARENTHOOD APPROVAL SCALE QUESTIONS

1. Would you like to have children in the next few years?
Definitely no**** ** ** ** ** Definitely yes
2. If you were to have a child in the next few years, how would you feel?
Feel negative**** ** ** ** ** Feel positive
3. How disappointed would you be if you did NOT have a child in the next few years?
Not at all disappointed**** ** ** ** ** Very disappointed

There are certain circumstances when a woman might consider having an abortion.

Please say in each of the following cases whether you think it would be acceptable, unacceptable or somewhere in between for the

woman to have an abortion.

You can do this by selecting one of the points on the scale.

GENERAL ABORTION APPROVAL SCALE QUESTIONS

1. Continuing the pregnancy would severely harm the woman's health
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
2. The woman decides she does not have enough money to support a child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
3. The woman's parents do not want her to have the child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
4. The child's father is not interested in being involved with the child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
5. The pregnancy is likely to result in a child with a physical or mental disability.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
6. The woman decides she would prefer to continue with education or working life instead of having a child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
7. The woman simply doesn't want to have a child (the reason doesn't matter).
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
8. The woman is not married.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
9. The woman is under 18 years old.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
10. The pregnancy is the result of a rape.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE

SUBJECTIVE LIFE EXPECTANCY

If you had to take a guess about what age you will be when you die, what would you say?

OBJECTIVE CURRENT SOCIOECONOMIC STATUS

1. What kind of job are you currently doing?
 - * Unemployed
 - * Semi-skilled or unskilled manual
 - * Skilled manual
 - * Clerical/administrative
 - * Professional/managerial
 - * Student
 - * Prefer not to answer

2. What is the the highest level of educational qualification that you have?
Please select one of the categories below.
 - * No qualifications
 - * Fewer than 5 GCSEs grades A-C
 - * 5 or more GCSEs grade A-C
 - * Foundation degree or NVQ L4 and 5
 - * AS-level or A-level or Access qualification
 - * Bachelor's degree or teaching qualification
 - * Master's degree
 - * Doctorate
 - * Prefer not to answer

SUBJECTIVE CURRENT AND FUTURE SOCIOECONOMIC STATUS

Please show on the scale your response to the following statements.

- a) I have enough money to buy things I want: Strongly disagree **** * Strongly agree
- b) I don't worry too much about paying my bills: Strongly disagree **** * Strongly agree
- c) I don't think I'll have to worry too much about money in the future: Strongly disagree **** * Strongly agree

OBJECTIVE CHILDHOOD SOCIOECONOMIC STATUS

Now think of whichever of your parents was the highest income earner up until you were 12 years old.

What type of job was the highest-paid one they had?

- * Unemployed
- * Semi-skilled or unskilled manual
- * Skilled manual
- * Clerical/Administrative
- * Professional/Managerial
- * Prefer not to answer
- * Don't know

Up to age 12, did you mostly (i.e. for over half the time) live in:

- * Housing which your family owned (this includes a mortgage)
- * Housing which your family rented (this includes private rented and social housing)
- * Prefer not to answer
- * Don't know

Up to age 12, did you and your family have to move house due to financial problems?

- * Yes
- * No
- * Prefer not to answer

SUBJECTIVE CHILDHOOD SOCIOECONOMIC STATUS

Please show on the scale your response to the following statements.

a) My family usually had enough money for things when I was growing up: Strongly disagree **** *

**** * Strongly agree

b) I grew up in a relatively wealthy neighbourhood: Strongly disagree **** * Strongly agree

c) I felt relatively wealthy compared to the other kids in my school: Strongly disagree **** * Strongly agree

**** * Strongly agree

OTHER QUESTIONS

Have you started to have sexual relationships?

- * Yes
- * No
- * Prefer not to answer

At what age did you begin to have sexual relationships?

Do you have religious beliefs?

- * Yes
- * No
- * Prefer not to answer

What is your religion?

- * Christian
- * Muslim

- * Jewish
- * Buddhist
- * Hindu
- * Sikh
- * Other (please type in the box)
- * Prefer not to answer

How strong are your religious beliefs on a scale from 'very weak' to 'very strong'?

Very weak *** ** Very strong

Do you prefer a romantic partner with a high level of education?

- * Yes
- * No
- * Prefer not to answer

Do you have any sisters?

- * Yes
- * No
- * Prefer not to answer

In general, does your sister/do your sisters do well at school? (Now or in the past)

- * Yes
- * No
- * Prefer not to answer

Do you have any brothers?

- * Yes
- * No
- * Prefer not to answer

In general, does your brother/do your brothers do well at school? (Now or in the past)

- * Yes
- * No
- * Prefer not to answer

Who did you mostly live with (more than half the time) until you were 12 years old?

What is your ethnic group?

Please select the option that describes you.

- * White British
- * White Irish
- * Any other White background (please write in)
- * Mixed White and Black Caribbean
- * Mixed White and Black African
- * Mixed White and Asian
- * Any other Mixed background (please write in)
- * Asian or Asian British Indian
- * Asian or Asian British Pakistani
- * Asian or Asian British Bangladeshi
- * Any other Asian background (please write in)
- * Black or Black British Caribbean
- * Black or Black British African
- * Any other Black background (please write in)
- * Chinese
- * Any other ethnic group (please write in)
- * Prefer not to answer

What is your postcode?

By this we mean the postcode of the flat or house you are currently living in.

We are asking this so we can find out more about aspects of your neighbourhood.

Please type your FULL postcode below.

**6.5 Appendix E: Questionnaire for Chapter 4's Morbidity/Mortality
Salience Experiment**

APPENDIX D: MORBIDITY/MORTALITY SALIENCE QUESTIONNAIRE

SCREENER QUESTIONS

SEX

What sex are you? *

- * Male
- * Female

What age group are you in? *

Please select your age in years from the categories below.

- * Under 18
- * 18-25
- * 25-34
- * 35 and over

What is your exact age? *

Please choose your exact age in years from the options below

- * 18
- * 19
- * 20
- * 21
- * 22
- * 23
- * 24
- * 25

What country do you currently live in? *

- * England
- * Wales
- * Other

Where did you live up to age 18? *

- * England
- * Wales
- * Other

Are you married? *

- * Yes
- * No

Are you living with a romantic partner? *

- * Yes
- * No

Do you have any children? *

- * Yes
- * No

Has someone close to you recently died? *

- * Yes
- * No

Are you suffering from a life-threatening illness? *

- * Yes
- * No

Are you suffering from a long-term illness? *

- * Yes
- * No

Are you pregnant or do you think you might be? *

- * Yes
- * No

Have you recently been pregnant? *

* Yes

* No

Do you have a romantic partner who is pregnant or thinks she might be? *

* Yes

* No

Do you have a romantic partner who has recently been pregnant? *

* Yes

* No

MORBIDITY SALIENCE CONDITION

For the following quiz, simply answer each question the best you can.
For many of the questions there is no right or wrong answer.

1. How many people do you think were diagnosed with a chronic (long-term) illness in England and Wales in 2011?
* Around 200,000
* Around 300,000
* Around 500,000

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. Below is a list of some of the main long-term illnesses affecting people in England and Wales in 2011.
Please type the LETTER of the one you think
1) MOST common
2) LEAST common
A. Type 2 Diabetes
B. Heart Disease
C. Arthritis
D. Respiratory disease
E. Obesity
F. Liver disease
G. High blood pressure
3. Compared with your friends and family, how upset do you get when long-term illness is shown in the media (e.g. films, TV, books, newspapers)?
Much less upset than them ***** Much more upset than them
4. How frequently do you think about long-term illness?
Every day ***** Never
5. At any point in your life, have you ever thought that you might have a long-term illness?
* Yes
* No
6. If it were possible, would you want to know when in the future you might be diagnosed with a long-term illness?
* Yes
* No
7. In the past, has a close friend or a family member been diagnosed with a long-term illness?
* Yes
* No
If yes, how old were they at the time of their diagnosis?
8. Some people worry at the thought of being diagnosed with a long-term illness. Does the thought of such a diagnosis ever cause you concern?
9. Some people believe that being diagnosed with a long-term illness means everyday life becomes very different. Is this a view you share?

MORTALITY SALIENCE CONDITION

For the following quiz, simply answer each question the best you can.
For many of the questions there is no right or wrong answer.

1. How many people do you think died in transport accidents in England and Wales in 2011?
* Around 2000
* Around 3000
* Around 5000

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. Below is a list of some of the different ways that people died in England and Wales in 2011. Please type the LETTER of the one you think is
1) MOST common
2) LEAST common
A. falls
B. fire
C. vehicle accidents
D. murder
E. drowning
F. poisoning
G. electrocution
3. Compared with your friends and family, how upset do you get when death is shown in the media (e.g. films, TV, books, newspapers)?
Much less upset than them ***** Much more upset than them
4. How frequently do you think about death?
Every day ***** Never
5. At any point in your life, have you ever felt that you were about to die?
* Yes
* No
6. If it were possible, would you want to know the exact date you were going to die?
* Yes
* No
7. In the past, have you experienced the death of a close friend or family member?
* Yes
* No
If yes, how old were they at the time of their death?
8. Some people worry at the thought of their own death. Does the thought of your death ever cause you concern?
9. Where do you think you will be when you die?

CONTROL: LOST PROPERTY CONDITION

For the following quiz, simply answer each question the best you can.
For many of the questions there is no right or wrong answer.

1. How many items of lost property do you think were handed into Network Rail in the UK in 2011?
* Around 2000
* Around 3000
* Around 5000

To continue, click on Next Page.

If you cannot answer or you do not want to answer this question, you can EITHER:

- click on Next Page to continue

OR

- close the browser to quit the study completely. You are free to do this at any time.

2. The items below are all often lost in England and Wales each year.
Please type the LETTER of the one you think
1) is MOST commonly lost
2) is LEAST commonly lost
A. gloves
B. travel tickets
C. wallets/purses
D. keys
E. mobile phones
F. clothing
G. umbrellas
3. Compared with your friends and family, how upset do you get when you lose something?
Much less upset than them ***** Much more upset than them
4. How frequently do you lose things?
Every day***** Never
5. At any point in your life have you ever lost an item of property on a train, bus or plane?
* Yes
* No
6. If it were possible, would you want to know the exact date you were next going to lose something?
* Yes
* No
7. In the past, have you ever lost something that was very valuable?
* Yes
* No
If yes, how much was it worth?
8. Some people find ways to avoid losing things, like always keeping items in the same place.
Does the thought of losing things make you want to use such strategies?
9. Some people eventually get to a point where they stop losing things.
Do you personally think you will always lose things?

If you would like to further discuss the issues raised in the questions you have just answered, please email
sandra.virgo@lshrm.ac.uk

POSITIVE AND NEGATIVE AFFECT SCALE (PANAS)

Thinking about yourself and how you feel right now, to what extent do you feel:

UPSET?

Not at all | 2 3 4 5 Extremely

HOSTILE?

Not at all | 2 3 4 5 Extremely

ALERT?

Not at all | 2 3 4 5 Extremely

ASHAMED?

Not at all | 2 3 4 5 Extremely

INSPIRED?

Not at all | 2 3 4 5 Extremely

NERVOUS?

Not at all | 2 3 4 5 Extremely

DETERMINED?

Not at all | 2 3 4 5 Extremely

ATTENTIVE?

Not at all | 2 3 4 5 Extremely

AFRAID?

Not at all | 2 3 4 5 Extremely

ACTIVE?

Not at all | 2 3 4 5 Extremely

Next follow some questions about your attitudes towards abortion.
There are no right or wrong answers so please just give your honest response.

PERSONAL ABORTION APPROVAL QUESTIONS

FOR WOMEN:

If you discovered you were pregnant now, would you have an abortion?

Definitely no 3 2 1 0 1 2 3 Definitely yes

FOR MEN:

If you had a girlfriend who discovered now that she was pregnant by you, do you think she should have an abortion?

Definitely no 3 2 1 0 1 2 3 Definitely yes

EARLY PARENTHOOD APPROVAL SCALE QUESTIONS

1. Would you like to have children in the next few years?
Definitely no**** ** ** ** ** Definitely yes
2. If you were to have a child in the next few years, how would you feel?
Feel negative**** ** ** ** ** Feel positive
3. How disappointed would you be if you did NOT have a child in the next few years?
Not at all disappointed**** ** ** ** ** Very disappointed

IDEAL NUMBER OF CHILDREN

If you could choose the ideal number of children to have during your whole life, how many would that be?

IDEAL AGE TO START HAVING CHILDREN

What do you think is the ideal age to start having children?

There are certain circumstances when a woman might consider having an abortion. Please say in each of the following cases whether you think it would be acceptable, unacceptable or somewhere in between for the woman to have an abortion. You can do this by selecting one of the points on the scale.

GENERAL ABORTION APPROVAL SCALE QUESTIONS

1. Continuing the pregnancy would severely harm the woman's health
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
2. The woman decides she does not have enough money to support a child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
3. The woman's parents do not want her to have the child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
4. The child's father is not interested in being involved with the child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
5. The pregnancy is likely to result in a child with a physical or mental disability.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
6. The woman decides she would prefer to continue with education or working life instead of having a child.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
7. The woman simply doesn't want to have a child (the reason doesn't matter).
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
8. The woman is not married.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
9. The woman is under 18 years old.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE
10. The pregnancy is the result of a rape.
Abortion is UNACCEPTABLE 3 2 1 0 1 2 3 Abortion is ACCEPTABLE

SUBJECTIVE LIFE EXPECTANCY (FOR THOSE IN MORTALITY SALIENCE CONDITION)

If you had to take a guess about what age you will be when you die, what would you say?

SUBJECTIVE DISABILITY-FREE LIFE EXPECTANCY (FOR THOSE IN MORBIDITY SALIENCE CONDITION)

Until what age do you expect to be healthy and active?

OBJECTIVE CURRENT SOCIOECONOMIC STATUS

What kind of job are you currently doing?

- * Unemployed
- * Semi-skilled or unskilled manual
- * Skilled manual
- * Clerical/administrative
- * Professional/managerial
- * Student
- * Prefer not to answer

What is the the highest level of educational qualification that you have?

Please select one of the categories below.

- * No qualifications
- * Fewer than 5 GCSEs grades A-C

- * 5 or more GCSEs grade A-C
- * Foundation degree or NVQ L4 and 5
- * AS-level or A-level or Access qualification
- * Bachelor's degree or teaching qualification
- * Master's degree
- * Doctorate
- * Prefer not to answer

SUBJECTIVE CURRENT AND FUTURE SOCIOECONOMIC STATUS

Please show on the scale your response to the following statements.

- a) I have enough money to buy things I want: Strongly disagree **** * Strongly agree
- b) I don't worry too much about paying my bills: Strongly disagree **** * Strongly agree
- c) I don't think I'll have to worry too much about money in the future: Strongly disagree **** * Strongly agree

OBJECTIVE CHILDHOOD SOCIOECONOMIC STATUS

Now think of whichever of your parents was the highest income earner up until you were 12 years old. What type of job was the highest-paid one they had?

- * Unemployed
- * Semi-skilled or unskilled manual
- * Skilled manual
- * Clerical/Administrative
- * Professional/Managerial
- * Prefer not to answer
- * Don't know

Up to age 12, did you mostly (i.e. for over half the time) live in:

- * Housing which your family owned (this includes a mortgage)
- * Housing which your family rented (this includes private rented and social housing)
- * Prefer not to answer
- * Don't know

Up to age 12, did you and your family have to move house due to financial problems?

- * Yes
- * No
- * Prefer not to answer

SUBJECTIVE CHILDHOOD SOCIOECONOMIC STATUS

Please show on the scale your response to the following statements.

- a) My family usually had enough money for things when I was growing up: Strongly disagree **** * Strongly agree
- b) I grew up in a relatively wealthy neighbourhood: Strongly disagree **** * Strongly agree
- c) I felt relatively wealthy compared to the other kids in my school Strongly disagree **** * Strongly agree

OTHER QUESTIONS

Have you started to have sexual relationships?

- * Yes
- * No
- * Prefer not to answer

At what age did you begin to have sexual relationships?

Do you have religious beliefs?

- * Yes
- * No
- * Prefer not to answer

What is your religion?

- * Christian
- * Muslim
- * Jewish
- * Buddhist
- * Hindu
- * Sikh
- * Other (please type in the box)
- * Prefer not to answer

How strong are your religious beliefs on a scale from 'very weak' to 'very strong'?
Very weak *** ** Very strong

Do you prefer a romantic partner with a high level of education?

- * Yes
- * No
- * Prefer not to answer

Do you have any sisters?

- * Yes
- * No
- * Prefer not to answer

In general, does your sister/do your sisters do well at school? (Now or in the past)

- * Yes
- * No
- * Prefer not to answer

Do you have any brothers?

- * Yes
- * No
- * Prefer not to answer

In general, does your brother/do your brothers do well at school? (Now or in the past)

- * Yes
- * No
- * Prefer not to answer

Who did you mostly live with (more than half the time) until you were 12 years old?

What is your ethnic group?

Please select the option that describes you.

- * White British
- * White Irish
- * Any other White background (please write in)
- * Mixed White and Black Caribbean
- * Mixed White and Black African
- * Mixed White and Asian
- * Any other Mixed background (please write in)
- * Asian or Asian British Indian
- * Asian or Asian British Pakistani
- * Asian or Asian British Bangladeshi
- * Any other Asian background (please write in)
- * Black or Black British Caribbean
- * Black or Black British African
- * Any other Black background (please write in)
- * Chinese
- * Any other ethnic group (please write in)
- * Prefer not to answer

What is your postcode?

By this we mean the postcode of the flat or house you are currently living in.

We are asking this so we can find out more about aspects of your neighbourhood.

Please type your FULL postcode below.

