

John MacInnes¹, Julio Pérez²

¹Department of Sociology, University of Edinburgh & Centre d'Estudis Demogràfics,
Universitat Autònoma de Barcelona. E-mail: john.macinnes@ed.ac.uk.

²Centre d'Estudis Demogràfics, Universitat Autònoma de Barcelona, E-mail:
jperez@ced.uab.es

The Reproductive Revolution

Abstract

A third 'revolution' alongside the better known economic and political ones has been crucial to the rise of modernity: the reproductive revolution. This comprises a historically unrepeatable shift in the efficiency of human reproduction. As well as clarifying the key role of demographic developments in the rise of modernity, the concept of reproductive revolution offers a better way to integrate sociology and demography. The former has tended to pay insufficient heed to sexual reproduction, individual mortality and the generational replacement of population. The latter has, paradoxically, undervalued its particular contribution to understanding the longitudinal dynamic of vital processes, so that demographic trends tend to be understood mostly as the outcome of other social forces. As well as reviewing some empirical evidence for the concept, its implications for debates on the demographic transition, family, the social regulation of sexuality, 'population ageing' and falling fertility are briefly discussed.

Mankind is like the sea, ever ebbing or flowing, every minute one is born another dies. Those that are the people this minute, are not the people the next minute. In every instant and point of time there is a variation. No one time can be indifferent for all mankind to assemble. (Filmer 1991 [1680])

Much attention has been paid to the political and industrial revolutions that ushered in modernity, transforming the economy, producing the modern state and unleashing individualism (Hobsbawm 1962). However a third revolution, as important as its better known siblings, has been overlooked: the reproductive revolution in the efficiency of production of human beings. The reproductive revolution is a one-off historical process in which the quantitative efficiency of the reproductive system undergoes a qualitative leap which transforms the traditional relation between reproductive ‘input’ (in its simplest form ‘number of births’) and reproductive ‘output’ (in its simplest form ‘size of population’). Both input and output can be defined in readily measurable and empirically testable terms. Moreover, not only has demography identified the empirical mechanism responsible for this revolution (the increase in lifespan associated with each birth) but has also provided an exact measure: *we need merely relate the generational rate of reproduction of years of life (Henry 1965) to the number of children per mother needed to maintain a population at a stable size.* There are two aspects to the reproductive revolution. One is the decline in the number of births per woman needed to secure generational replacement. The second is the labour input to each birth. Most of the world has undergone this revolution over the last two centuries, and especially in the last fifty years. However in different times and places its relationship to its sister revolutions has taken different forms, as has the relation between its two aspects.

The progress of the reproductive revolution over time can best be represented by a logistic curve. The reproductive *potential* of humans is great: some groups have reached averages as high as nine or ten live births per woman. Primitive levels of material development during most of human prehistory, together with the risky nature of human sexual reproduction for mothers and babies, required this potential to be used fairly fully

simply to *maintain* population levels. For example, the completed fertility of cohorts of women born at the start of the nineteenth century was around five in countries as diverse as Finland, Sweden, Norway, Holland, England and Wales, Italy, Germany and Spain (Festy 1979). The efficiency of the system over the long term was low and relatively unchanging. Over the short term, of course, demographic crises caused by disease, war or famine threatened replacement (Coale 1986; Livi Bacci 2001). Breakthroughs to higher levels of efficiency may have been achieved, but these were neither sustained nor generalised. Most women spent most of their (brief) adult lives pregnant, lactating or rearing children, with the exception of those few fortunate enough to survive beyond their forties, or to have the power or status to delegate their reproductive tasks to others.

For example, in Spain at the start of the last century (1900), just over one fifth of all children died in their first year. A similar proportion of the survivors died before their fifth birthday. After that mortality rates decrease, but by their thirtieth birthday just under another fifth of these survivors died, leaving barely half the original cohort alive at age 30, and two fifths by age 45 (Pérez Diaz 2003). Since not every woman surviving to their fertile years could become a mother (in Spain at the start of last century one in ten women remained unmarried, principally through the lack of marriageable men), those who did so had to bear five or six children if generational replacement was to be accomplished. Childbirth was a dangerous time for both mother and baby. For example in Scotland in the 1920s – a country much more advanced economically than Spain at the time – almost one per cent of pregnancies ended in the mothers' death. That rate has now been reduced one hundredfold so that the lifetime risk of dieing in childbirth is tiny: one in twenty or thirty thousand. However in some African countries where the reproductive revolution has yet to occur the lifetime risk of maternal death is as high as one in eight (World Health Organisation 2004).

It is not difficult to see that under such conditions, those women lucky enough to survive to childbearing ages, would see the bulk of their fertile years dominated by reproductive work. Women in Spain reaching 15 years of age in 1915 had an average remaining life expectancy of 43 years. We could guesstimate that at least a quarter, and often a half or

more, of those years would be dominated by such work. Within this time such women would be likely to see one or more of their children predecease them. Moreover, the precariousness of life would leave her little guarantee that either her or her husband would themselves survive to see their children reach adulthood. The widespread existence of the institution of godparents was an insurance against the real possibility of the early death of both parents. Thus, one in six children born in the first decade of this century in Spain lost their father before their fifteenth birthday, and one in ten lost their mother. By the time these children were in their fertile years themselves their offspring were unlikely to grow up with many surviving grandparents (Pérez 2001).

Once the reproductive revolution begins, however, reproductive efficiency rises rapidly, so that in a century or less, the number of births per woman necessary to replace population falls to less than half its previous level. This leap in efficiency has two causes: the proportion of women surviving to the end of their childbearing years increases while the children they bear themselves lead longer lives. The rise in efficiency starts to level off once ever larger proportions of women survive to the end of their childbearing years. Henceforth gains in efficiency become more dependent only on increases in years of life per birth, rather than on the combined effect of this and reductions in female mortality prior to menopause. Depending on whether we assume longevity to have a set biological limit or not (Wilmoth 1999; 2000), the curve either eventually levels off, or continues a gentler rise. The vast majority of those born now live long enough not only to become parents themselves, but also to enjoy a substantial and active period of life after that, not only seeing their children become independent but seeing them having children (and even grandchildren) themselves. For example in the UK in the year 2000, six out of ten babies born had *all four* grandparents known to be alive when they were born, while a mere two per cent had only one or no surviving grandparent¹. The reproductive work of these

¹ Author's analysis UK Millenium Cohort Study Centre for Longitudinal Studies. 2004. "Millennium Cohort Study First Survey 2001-2003[computer file] 2nd Edition. February. SN: 4683. University of London. Institute of Education." Colchester, Essex: UK Data Archive [distributor].. This understates the demographic change in that a proportion of grandparents are alive but not definitely known to be so by their children.

grandparents is increasingly important, a fact that has not gone unnoticed by those searching for ‘evolutionary’ theory accounts of human longevity (see e.g. Lee 2003).

Because of its origins in the breakthrough constituted by the mass survival of women to the end of their fertile years this gain in reproductive efficiency is by definition a one-off event. While some of its proximate causes lie in social and economic progress that facilitates such mass survival, the dynamic of the revolution itself is demographic, determined by the empirical characteristics of the sexual genesis and mortality of human beings. These characteristics make the kind of longitudinal perspective that only a proper integration of sociology and demography can provide, and which we propose here, a prerequisite to understanding social change. Thus while we do *not* argue that demography need not seek ‘inter-disciplinary’ explanations, and do *not* propose demographic ‘endogamy’ (van Wissen & Dykstra 1999) we do argue that demography has not only a distinct but also a necessary contribution to make. Specifically demographic processes are a vital part of the explanation.

The reproductive revolution has three direct consequences, all of which facilitate its companion revolutions. First, by making reproduction more efficient it liberates resources for production. The proportion of what were anyway short and precarious lives devoured by the need to recreate life itself becomes a much smaller part of longer, more secure lives. Second, by vastly decreasing the importance of the ineluctably biological division of labour in reproduction in people’s lives it erodes the material base of patriarchy and paves the way for the feminisation of the public sphere and creates the material context for successful feminist struggle. Feminist ideas have existed for millennia. Their practical realization is little more than a century old. Mann has suggested that liberalism has never been able to resist feminism, however it is the material platform of the RR that has made this possible. Finally, it transforms sexual behaviour from a public to a private activity. These latter two changes have been noted but misunderstood by the debates over both the ‘first’ and ‘second’ demographic transitions. These have tended to see values as the cause, rather than the consequence of reproductive behaviour change. In our analysis, it is

the reproductive revolution is the essential precondition for such values to descend from the realm of utopia to practical possibility.

What we call the reproductive revolution has been understood as the ‘demographic transition’, after Thompson’s 1929 *American Journal of Sociology* article first identified three groups of countries corresponding to the two end points of the transition from ‘high’ to ‘low’ fertility and mortality and the third, intermediate, group of low mortality countries where fertility rates were ‘coming under control’ (1929: 959). However, the subsequent eighty years of debate have failed to produce much consensus either about the causes or characteristics of this transition, nor, surprisingly, what two distinct demographic regimes the transition was between, or what, aside from empirical description, the terms ‘high’ or ‘low’ might mean. It was routinely assumed or asserted that ‘the fundamental economic and social changes of modernization or development’ (Teitelbaum and Winter 1986: 14) lay behind the transition, but it has proved impossible to demonstrate this empirically. Pre-transition societies proved more diverse than expected, and variables associated with modernization stubbornly fail to predict demographic change. However, if we drop the assumption that the reproductive revolution is simply the *result* of ‘external’ economic and social progress, and instead take account of its internal demographic logic, we can see it clearly as a necessary *condition* of such progress itself.

It is useful to distinguish between two aspects of reproductive labour: (1) the relationship of births to generational replacement and population level and (2) the labour input per birth. The first is a strictly quantitative measure of the efficiency of human reproduction that allows us to see most clearly the qualitative leap in human reproductive efficiency over the last two centuries. However this transformation also takes the form of changes in the second aspect, both in terms of the nature of this labour, and its relationship to other forms of labour.

The relationship between these two aspects is complex and variable, both over time and across countries. For example the order of events in Spain appears to have been that first

the 'actuarial' efficiency of the system improved, allowing fertility to fall enough to create an *increase* in the input of reproductive labour associated with each birth which in turn fostered further increases in life expectancies and efficiency in the first sense. This allowed a strictly temporary flourishing of the male breadwinner system, in which women could devote a large proportion of their longer lives exclusively to reproductive labour. More married, at younger ages, and had children more quickly. However, considered as a reproductive system, and not just as one that erected a sexual division of labour and opportunity between paid and unpaid work (Parsons 1956) the essence of the male breadwinner system was how rapidly its capacity to revolutionise the efficiency of reproductive labour abolished its own pre-conditions of existence: it literally died of success, as the weight of the biological division of labour in reproduction fell and women were freed (or expelled) to work in other sectors, or in less direct reproductive work (e.g. in public education and health systems).

In this sense we can visualise reproduction as a fourth (or rather first) sector of the economy, analogous to agriculture, industry and services. Rising productivity ultimately results in the decline in the relative size of the workforce and the expulsion of part of it to other sectors. Of course, the biological division of labour in sexual reproduction, and the strict limits to the potential 'industrialisation' of the family mean that instead this expulsion mostly takes the form of people dedicating relatively less time to work in this sector across their life course. However, the basic point cannot be emphasised enough. A fundamental precondition of the successful transition to modernity is a reproductive revolution permitting the liberation of productive effort from the daily struggle to maintain population in the face of war, famine and disease.

Reproductive efficiency has various directly social dimensions and manifold social consequences as we discuss further below. The reproductive revolution has taken place within quite diverse social arrangements regulating reproductive work (for example the way in which the state redistributes resources between parents and non-parents or shares the burden of reproductive work by providing education, health or childcare services to parents). Finally, as an essentially global process, it has of necessity taken diverse forms

in different time periods, at different levels of economic and social development in successive countries. In what follows we make frequent reference to the specific case of Spain, as the relatively recent and rapid nature of the revolution there renders it unusually visible

The consequences of the reproductive revolution

The reproductive revolution has five key consequences, although one is simply a part of the revolution itself. As in other cases such as the industrial and information technology revolutions, the first consequence is that the proportion of reproductive labour within the total volume of productive activity *decreases*, freeing energy and resources for other activities. This shift becomes visible as *falling fertility rates* as fewer children are needed to ensure generational replacement or maintain population at a given level, while each individual couple faces a much lower risk of their children predeceasing them. There is no direct causal link between reproductive efficiency and fertility, but history shows few examples of societies where such efficiency gains, once established, have been devoted to multiplying their reproductive power rather than diminishing the proportion of effort dedicated to reproduction. As the cases of Spain and Italy demonstrate, if life expectancy is rising, population can keep growing, net of migration effects, even when the period total fertility rate falls well below the (misconceived) ‘replacement level’ of 2.1.

It is useful to compare reproductive with other forms of labour. Smith, Marx and other classical economists described how the extension of the division of labour and accumulation of capital could revolutionise productivity. Until the reproductive revolution occurs, reproductive labour was rarely subject to much extension of the original, biological determined, division of labour in conception, parturition and lactation. The revolution transforms this in two ways. First, many more people come to share in reproductive labour. Longer lives permit the extension of the division of reproductive labour across more family members and over longer life courses. Still more important is that a vastly increased proportion of each generation of women survives into their fertile years to participate in this work in the first place. Second, reproductive labour becomes spectacularly more efficient as its products come to last much longer and have much

higher 'value'. Infants are born who will not only reach their own fertile years in much greater numbers, but will then go on, as grandparents, to do yet more reproductive work. Reproductive labour comes to benefit enormously from 'capital accumulation' in two senses. Technological progress in other sectors, leads to improvements in diet, living and housing conditions, medical knowledge and public health, reducing mortality. Thus alongside the improvement in the ratio of births to generational replacement, lie changes in the amount and productivity of reproductive labour associated with each birth. At the same time, the need for infants to establish an intense and enduring relationship with a limited number of adults who take responsibility for their care has set severe limits to the 'industrialisation' of the family presaged by Davis (1937) and others.

Because children are more 'cumbersome' (Myrdal 1968) in a mobile, market society, demographic transition theories have generally concluded that the costs of child rearing increase with economic development, and attempt to explain falling fertility in this way (e.g. by theorising a reversal in the intergenerational flow of wealth). On the contrary, the theory of reproductive revolution hypothesises that the costs of production of children, at least in terms of necessary labour time devoted by parents, *falls* dramatically, even as the value of children (in terms of the average social capital they possess, education received, or earnings potential) rises continuously. What does fall is the willingness of parents to bear these costs, while the share that is socialised and borne by the state increases.

The *opportunity* cost of children does rise, as Davis and Myrdal noted. But this fact only makes sense if understood within the context that general economic development, by multiplying opportunities, must by definition increase the 'opportunity cost' of every conceivable time consuming activity (Becker 1965, Linder 1970). Having children may require foregoing ever expanding leisure opportunities, but no more so than enjoying leisure opportunities requires foregoing ever expanding opportunities to have children! People in post-reproductive revolution societies have fewer children not because they can no longer afford them, but, on the contrary, because for perhaps the first time in human history they, and the societies they inhabit, can afford *not* to.

The second consequence of the reproductive revolution is thus the redistribution of reproductive work both *within* and *between* generations. Within each generation more women survive long enough to reach fertile ages and thus share in reproductive labour. As we shall argue below, the reproductive revolution also undermines patriarchy, so that the reproductive burden also comes to be shared more equally with men. Meanwhile longer life spans mean that there are not only more surviving mothers and fathers, but also grandmothers and grandfathers to share in this work. Within the family, generation gradually starts to supplant gender as the principle determinant of the distribution of reproductive work across the life course.

A third consequence, is thus that the smaller volume of reproductive work not only comes to form a decreasing proportion of people's lengthening lives, but becomes *less concentrated in time across these lives*. At first, paradoxically, it is likely that the opposite occurs. In Spain, for example the length of time between marriage and birth of first child fell, and pregnancies were concentrated in a short period. Later, however, as the weight of reproductive labour fell further and starts to be redistributed, first births came to be ever more delayed, and spaces between subsequent births (if indeed there were any) increased (Devolder 2005; Requena 1997). Meanwhile the labour associated with these births came to be shared out among more family members (fathers, grandparents) and either provided by the state or purchased in the market. Parents may expect help in performing it from their own parents, (whom prior to the reproductive revolution would have usually died before witnessing the birth of their grandchildren) and even their grandparents, while in return, they may expect to undertake such labour themselves both as parents and later as grand- or great-grandparents. The UK millennium cohort study, for example found that although only one in twenty babies shared a household with a grandparent, one half of those with working mothers were looked after by grandparents while their mothers were at work, and three out of four were cared for by grandparents at other times. Nor was childcare the only means of grandparental support. One third of mothers and a similar proportion of fathers reported receiving essential or

financial help from their own parents (loans, money or physical capital gifts, domestic equipment, help with housing etc.) in addition to gifts or extras for the baby.²

This redistribution of reproductive work across the life course has sometimes been seen, together with the extra gains in longevity by women, as the ‘feminisation’ of old age (eg Pérez Díaz 2003). However this is, misleadingly, to apply a link between reproductive work and gender that is itself *weakening* because of this very change! Reproductive labour is being re-distributed between the sexes. What is occurring is not the feminization of old age but the partial *de-feminisation* of reproductive work and its redistribution across the life course, as part of the shift from gender to generation, made possible by the increasing co-existence of three and often four generations in the same filial line. When they retire, or reduce their paid work hours, men’s roles may lose their previous ‘productivist’ status, allowing them to migrate towards ‘reproductivist’ roles. Longer lives, themselves a product of the reproductive revolution, together with falling activity rates for those over fifty, now facilitate grandparents’ reproductive labour.

Within this altered scenario, the influence of the core biological division of labour is reduced, both because fertility levels can fall, and because the link between the biological and social sexual division of reproductive labour is weakened, so that a fourth, and historically unprecedented, result of the reproductive revolution is the decline of patriarchy, the rise of feminism and the creation of a core feminizing logic within modernity that ultimately leads to contemporary seismic shifts in what is commonly termed gender relations (Connell 2002) but which we prefer to think of as social relations between the sexes (MacInnes 1998). The inefficiency of the pre-revolution reproductive system condemned most women to spend most of their adult lives pregnant or breastfeeding neonatal infants. Until the reproductive revolution, this was true of almost all known societies on earth. This has received little attention in sociology, yet it surely explains the hitherto ubiquitous dominance of patriarchy, even though there is room for debate over how best to analyse the precise nature of the causal link and the

² Author’s analysis UK Millennium Cohort Study Ibid..

tremendously variable social form it has taken (MacInnes 1998). It is hardly surprising that social relations took a patriarchal form when women were such a scarce 'means of reproduction' of the population (Gil Calvo 1991; Meillassoux 1981; Rubin 1977). Perhaps the greatest achievement of the reproductive revolution is to liberate women by dint of reducing the relative scarcity of their reproductive labour.

Heterosexual intercourse is still normally central to sexual reproduction (but no longer inevitable, given *in vitro* fertilization and sperm and egg donation). Pregnancy is necessary, but, as in the past, compatible with other productive work until its later stages. Lactation may be seen as desirable for nutritional, health or psychological reasons, but is readily substitutable by other feeding methods, or rendered more flexible by technology facilitating the expression and conservation of breast milk. As well as increasing the efficiency of some aspects of reproductive labour (disposable nappies, bottled milk, pre-prepared foods, baby alarms and so on) technological innovation loosens the link between reproductive labour and sex so that it is no longer so directly tied to women as a sex. Ideology may still portray women as 'naturally' more suited than men to infant care, and moral panics over male child abuse may even police such a division of labour more tightly, but it is no longer *biologically* imposed and is rapidly being socially redrawn. Thus as well as mounting evidence of a slow but substantial increase in the proportion of reproductive work done by men (Gershuny 1992), there is a overwhelming contemporary support, on the part of both men and women, for greater change. In separate surveys conducted between 2002 and 2004 in Europe and North America, over nine out of ten women *and men* agreed not only that 'men should do more childcare' but also that they 'should take as much responsibility as women for home and children'³.

³ Authors analysis ISSP Family and Gender Roles III survey International Social Survey Programme. 2004. "Family and Changing Gender Roles III, 2002. [computer file] 1st edition, ZA3880;UK Data Archive SN5018." Köln: Zentralarchiv Für Empirische Sozialforschung. Colchester, Essex: UK Data Archive[distributor]. Authors análisis, European Social Survey Round 2. Jowell, R and the Central Co-ordinating Team (2005), European Social Survey 2004: Technical Report, London: Centre for Comparative Social Surveys, City University. European Social Survey Round 2 2005 [computer file] First edition. Norwegian Social Science Data Services [supplier].

The *idea* of equality between men and women has existed for millennia. Liberalism, or discourses of human ‘natural’ rights, have been defenceless against feminism (Mann 1994). Once it is admitted that natural differences between men are irrelevant to their moral equality, it is difficult to argue that such differences (of sex) between men and women *are* relevant. However the potential for the *practical* realization of greater sexual equality has only been released by the reproductive revolution, together with the evolution of the potentially sex-blind markets, bureaucracies and polities, and shift of production from the household towards the public sphere that this revolution has itself helped to create. This is what has made the triumph of feminism possible over the last century. It has reduced the edifice of patriarchy in Western societies to ruins with hardly the slightest organised or formal resistance from men (the guerrilla warfare of domestic and sexual violence or harassment is, of course, another issue). A feminising logic lies at the heart of the reproductive revolution. Paradoxically, while second wave feminist thought focused on ‘plastic’ sexuality and its symbolism, the real roots of gender change lay in the shrinking significance of reproductive sexuality.

Finally, less a consequence than a component of the reproductive revolution itself, is the dawn, for the first time in human history, of ‘mass maturity’. Over the last century, and more particularly over the last fifty years, people living in more affluent states have not only come to live much longer lives on average than their predecessors (gains in mean life expectancy), but survival to ‘old’ age has become widespread or ‘democratised’ (the proportions of each cohort surviving to given advanced ages have risen). Figure 1 charts this progress for women in Spain, while Figure 2 gives data for the first generations in Spain, Canada and Sweden where the proportion of those born who survived till their fiftieth year reached fifty per cent.

Hobbes famously remarked that in his ‘state of nature’ life was ‘solitary, poor, nasty, brutish and short’ (Hobbes 1991 (1651)). While much attention has been paid to the

social relations of nastiness and brutishness, the importance of emancipation from cruelly short lives, *both one's own and those of others*, has not been sufficiently appreciated. Knowledge of this emancipation has also become commonplace. Only in a world where people assume that reaching one's seventieth or eightieth year in robust health is normal can it make sense to discuss the provenance of threats to such an achievement in terms of 'risk'. Thus, for us, the contrasts made between 'risk' and 'fate' by theorists, such as Beck, Giddens or Lash, turns things on their head. They present what is experienced by most people as *liberation* from the fatal consequences of ignorance, disorder and want, as the socially constructed *domination* of people's lives by necessarily opaque scientific expertise and specialization (Beck, Giddens and Lash; Giddens 1991).

This development of mass maturity is no less fundamental than it is novel. Until not much more than a century ago, people in almost every corner of the globe could count themselves fortunate to survive much beyond their fortieth year. One in four or five usually died before their first birthday (see e.g. data in Pérez Diaz 2003). Not only are lives now getting steadily longer, and people's quality of life at any given age better, but mortality is increasingly concentrated in older ages, so that a long life is ever more a common expectation rather than seen as a stroke of fortune or God's special benediction. This democratisation of longevity becomes the kernel of the reproductive revolution once it reaches that point at which most women survive to the end of their fertile years. This sustained qualitative leap in the efficiency of the demographic system is not only historically unprecedented, but also unrepeatable. At the same time it comprises part of the essential structure of the launch platform for modernisation, freeing resources for development elsewhere. We discuss below the bizarre way in which this demographic achievement has come to be represented, on the contrary, as the impending threat of 'population ageing'.

The visibility of the reproductive revolution

It might be asked why, if it is so fundamental, the reproductive revolution has gone unrecognised. There are many answers, but let us highlight two. Sociology (and often demography) prefers transversal (cross-sectional) measures and analyses, particularly

where immediate policy relevance is sought. The reproductive revolution, mass maturity and social processes involved in the reproduction of society over time are only clearly visible using longitudinal measures. On the contrary, transversal measures make ‘population ageing’ far more visible compared to longitudinal measures. This problem is aggravated by the tendency to imagine societies (plural) as essentially discrete, two-dimensional structures⁴ whose essential characteristics may be captured by the social survey or census, and which change over time as they move up or down history as coherent units (Anderson 1991: 33). On the contrary we wish to emphasise the significance of mortal biographies and generational and life course change within a human society that spills across both state frontiers and time periods (MacInnes 2006).

The second part of the explanation is that the reproductive revolution tends to cover its own tracks. Not only was it an unplanned and unconscious process at the social level (although the individual level may be a very different matter); the material affluence it helped create has minimised its visibility by presenting reproductive behaviour that was formerly a virtually unavoidable collective obligation as a matter of apparently onerous personal choice. We return to this below in the context of discussing aspects of ‘technologically non-progressive’ labour (Baumol 1967).

The origin of the concept of reproductive revolution

The gestation of the concept of a reproductive revolution proposed here began with the search within demography for better indicators of reproduction than simple fertility, and has been spurred on by recent empirical research on generational demographic change. The role of the ‘French school’ in demography, which along with family studies (de Singly 1993), always placed more emphasis on ‘genealogy’ was central to this development; in particular the work of Henry (1965) and his concept of the reproduction of years of life. Unusually, Spain then played a key role in the development, through the work of two demographers who did their theses under the direction of the French school:

⁴ Visualised, for example, in terms of a dataset or as members of a ‘population’ distributed along the x-axis and their various characteristics plotted on a series of Y-axes.

Fernández Cordón (who went on to be director of the Instituto de Demografía) (1995; 1977; 1986) and Cabré i Pla (1979; 1999) who went on to become director of the Centre d'Estudis Demogràfics in Catalonia; and through the work of Luis Garrido (1992). It is in his article, 'La revolución reproductiva' (1996) that the expression itself was first employed.

Spain possesses various historic and demographic conditions that help account for this longitudinal analytic emphasis: the speed and historical compression of modernisation produced a particular constellation of generations with contrasting historical experiences living side by side, rather like a mass of geological strata concentrated in a small space. In around half a century Spain went from being an agrarian, rural society with the worst mortality in Europe to an urban, services based economy with one of the world's highest life expectancies. In countries where the reproductive revolution started earlier the generational mix of the population was less heterogeneous in terms of their historical experience, while in countries that still have to complete this revolution some generational profiles have yet to become sufficiently generalised to become salient. Thus in Spain it is not only easy to see that a cross sectional table of data by age in no way corresponds to any typical life course, but also that the content of the table will change dramatically in the next few years simply by virtue of the progressive substitution of each generation by its successor.

We are clearly making a bold - and for some, pretentious - claim when we argue that reproductive change has not only been revolutionary, but of such overarching significance as to compare with the other two, generally acknowledged, revolutions fundamental to the rise of modern society (Hobsbawm 1962). However, demographic change cannot simply be seen as an 'effect' or consequence of other social changes, changes that we might also use to understand the political and economic revolutions. Only by appreciating the interconnected nature of change within the demographic and other arenas can key aspects of modernity be understood. In this sense, we see approaches to the demographic transition which attempt to account for it in terms of material or cultural determinants or 'causes' as partial. Moreover, in developing what we

see as a sociology of reproduction, we do *not* mean a sociology of the social context *within which* reproduction (understood in terms of other dynamics) takes place. On the contrary it is part of our argument that the failure to take sufficient account of the sexual genesis of human beings and therefore of the social significance of the unique demographic change represented by the reproductive revolution has been a key theoretical weakness of contemporary sociology, unlike its pre-Second World War antecedents (MacInnes 1998; Wrong 1961)⁵. One illustration of this is the almost total divorce between the two disciplines, until concern about falling fertility, expressed first in policy circles and imported to the discipline from there, has recently rekindled some sociological interest. Another is the virtually universal assumption in sociology that social reproduction is a question of the reproduction of social structures, norms, roles, class positions or patterns of behaviour, rather than the maintenance of a supply of human beings to staff them. This latter has simply been taken as a ‘given’, whose origins and determinants merit little further investigation.

The social relevance of sexual reproduction, or human sexual genesis

In contrast to the strikingly demure way contemporary sociology averts its gaze from the carnal origins of individuals, the latter has five key implications which are given insufficient attention in current research and analysis:

1. The existence of two sexes necessary for reproduction forms the basis for the existence of a sexual division of labour which may be extended beyond reproduction to other spheres of social life and thus form the basis for the elaboration of gender distinctions and discrimination by sex. Social constructionist approaches that attempt to explain the analytic construction of biological sex categories of in terms of the social relations of gender (e.g. Kessler and McKenna 1978) simply standing things on their head.

⁵ By sexual genesis we mean that humans reproduce sexually as a species, so that every human being requires a biological father and mother, and the vast majority are born as clearly biologically male or female.

2. Sexual reproduction, individual mortality and finite and variable life spans presuppose each other. Unlike society which, especially after the invention of writing, becomes spatially infinite and potentially everlasting, humans are mortal and tied to an individual body located empirically in time and space (Craib 1994). In this lies the origin of the need for any population that is to survive over time to devote some of its activity to reproductive labour in the sense of sexually reproducing infant human beings to replace the deceased (Coale and Demeny 1983). Social reproduction thus requires not just the reproduction of social roles, structures, networks, ideologies or identities, but the biological reproduction of people to populate or carry them. The essence of the reproductive revolution is that this latter activity has become spectacularly more efficient over the last two centuries, and especially over the last fifty years, freeing human energies for other activities, including, of course, the elaboration of new patterns of reproductive activity itself.

3. Pelvises narrow enough for upright walking and brains large enough for human consciousness have meant that human sexual reproduction not only requires childbirth that is risky for the mother, but is also followed by a prolonged period of intense neonatal care by adults until such time as the human infant become reasonably capable of maintaining social relations autonomously (Dinnerstein 1987). It is also clear that such care depends heavily upon the long term and stable presence of a very small number of individuals, usually the biological parents or close relatives of the infant but not necessarily so. Such care, understood best in terms of 'attachment' (Bowlby 1971; Winnicott 1965) explains the universal existence of the family (e.g. Elshtain 1982; Goode 1964), in widely heterogeneous social forms of course, and also serves the analytical function of dividing off a private from a public sphere (MacInnes 1998). Reproduction can only with great difficulty be 'industrialised', 'commoditised', bureaucratised or otherwise rationalised and undertaken in other social institutions (pace Davis 1937). When this does happen, the results are extremely negative (e.g. the experience of those

raised in orphanages or children's homes). Of course this does not mean that families always perform reproductive work well, or that they are not, sometimes, the site of neglect, abuse, violence or murder of children (Alberdi and Matas 2002; Dobash and Dobash 1992; Kelly and Radford 1987).

4. Because sexual reproduction thus requires an institution like the family, but renders individual human beings mortal, the family has the potential to become the key institution regulating inheritance. Hence virtually all societies have until now sought to define and regulate legitimacy (Malinowski 1927; Morgan 1995). This could even take the form, for example in nineteenth century Britain or in Spain up until the second half of the last century, of defining illegitimate sexual relations (that might result in the birth of a child and potential inheritor) as a crime equivalent to theft of property because it put the inheritance of legitimate heirs at risk (Pateman 1988). The waning of legitimacy as a key axis of social status simply represents both the decline of the political power of the family in relation to the state, and the increase in the supply of reproductive labour.

5. The above consequences of sexual reproduction explain why sexuality has always been subject to intense forms of social control at both the level of society (both normatively and by the state or whatever other institutions of social order exist, for example councils of elders, churches) and at the level of the family itself. Until very recently virtually all known societies segregated the sexes in various ways, distinguished between legitimate and illegitimate offspring and regulated sexual relations, both through marriage and the prohibition or penalization of extra-marital sexual relations or non-reproductive forms of sexual activity. The reproductive revolution explains why such controls have rapidly disintegrated in affluent Western societies, allowing the distinction to emerge between reproductive and plastic sexuality and other changes that some observers have argued constitute the 'transformation of intimacy' (Giddens 1992; Jamieson 1998). However, to explain trends in fertility in terms of the relaxation of such controls, or changing norms and values, as in many versions of the 'second

demographic transition', is to turn things on their head once more. It is the reproductive revolution that makes such developments possible.

Some implications of the reproductive revolution

Understanding the nature of the reproductive revolution has implications both for sociological and demographic theory (especially the hegemony of transversal measures and analyses in both disciplines) and for the application of these theories to many contemporary policy debates. Clearly these are complex and wide-ranging issues. As a result we may be forgiven for adopting a somewhat didactic approach, in the remainder of this article and also for concentrating our remarks on a limited number of areas: the visibility of reproductive labour and fertility; the family; the state; and 'population ageing'.

Economic progress, the visibility of labour, individual autonomy and time

The great leap forward in efficiency of reproductive labour associated with the rise of modernity has to some extent been hidden from view by a simultaneous but quite separate development: the trend rise in a market based society of the relative cost of 'technologically non-progressive' and physically inalienable labour. By the former, following Baumol (1967) we mean labour that is not amenable to productivity improvement via substantial technological innovation; by the latter we mean activity whose results are inseparable from the presence of the person performing it. Most reproductive labour has these two features. This yields a paradoxical result that is key to any adequate understanding of current fertility trends in affluent societies. Just at that point in human history where the efficiency of sexual reproduction has been revolutionised, and the social controls on sexuality have all but disappeared, it comes to *appear* as something that is becoming so much more costly that it is only possible to maintain at all if an ever greater share of its burden is assumed by the state. Falling fertility rates reflect two developments: a fall in the level of fertility needed for replacement, and changes in the distribution of people's activity between reproductive and other labour: a distribution which is increasingly under their own control. The essence of this paradox is that the victory of the reproductive revolution becomes so

absolute that it falls prey to social amnesia. Only societies whose reproduction is assured can afford the luxury of thinking in terms of the ‘opportunity costs’ of children, or indeed any substantial personal input to reproductive decision-making at all.

There are two, distinct issues here. One is the social visibility of costs, an issue Baumol (1967) addressed in distinguishing technologically non-progressive activities. Within a market mechanism, the fantastic cheapening of commodities subject to technological innovation appears, paradoxically, as the relentless rise in cost of those commodities and activities which are not subject to this process. The essential point for our purposes is that the general cheapening of other commodities makes activities requiring a human presence and which do not directly employ technology⁶ *relatively* costlier compared to the purchase (although not always the consumption) of inanimate technology.

The second issue is the changing nature and content of reproductive labour itself. It is clear that pregnancy, childbirth, lactation and the construction of a secure and intimate parental relationship with an infant are not only activities which are overwhelmingly technologically non-progressive, but are also, almost uniquely in modern societies, *status specific*. That is to say, it matters *who* does them. A sales assistant, a manager, even a nursery teacher, are readily substitutable on the labour market. The parents or guardians of an infant are not. Moreover, as the productive forces develop, and the level and specialization of skills needed both in production and in other spheres of social life increase, or in Marx’s language, the value of labour power rises, (e.g. the development of general literacy, writing, communication and language skills, domination of common mechanical and later information and other electronic technology) not only does the volume of reproductive labour increase, but it becomes impossible for the family itself to sustain it: hence the development of universal education once industrialization has taken hold. Two contradictory forces operate here. Universal education and health services

⁶ Technological change in other sectors makes reproductive labour more efficient and facilitates its simultaneous performance with other activities, but no machine can make a child reach adulthood faster.

vastly extend the division of reproductive labour, but the value of the product increases, and thus the volume of reproductive labour absorbed in it.

Later still, as life chances, autonomy and mass maturity increase to the point where the mass of the population can imagine that they might plan their lives reflexively, assuming the construction of an 'identity', then the reproduction of infants capable of such an adventure might be seen to require still greater investment. Such developments lie behind Becker's (Becker 1991) contrast between the 'quantity' and 'quality' of children, although we disagree with the theoretical framework within which he places this, and the conclusions he draws. They also lie behind the trend rise in (increasingly 'expensive') time devoted to rearing children in affluent societies. Thus in Britain, over the last four decades or so, time diary evidence suggests that time devoted to childcare may have trebled (Gershuny and Fisher 2000).

The key to this enigma is to realise that it is only the tremendous development of the productive forces and general standard of living as a whole, facilitated by the reproductive revolution, that has so advanced the opportunities and life chances available to people, while simultaneously liberating them from direct obligations to perform reproductive work at all, should they so choose, that the latter appears as a 'costly' choice, or indeed as any choice at all. Again while moral conservatives lament that as a result the family has become a mere 'lifestyle choice' (Morgan 1995) or declining fertility rates attributed to selfish hedonism (McDonald 2000) or shirking the collective obligation to reproduce the very basis of society (Myrdal 1968) this is really vital (in every sense) *progress*. Moreover, an adequately longitudinal view of the family as an institution allows us to see that, far from undermining the material basis of the family, the reproductive revolution has ushered in its golden age by ensuring the survival at any point in time of an unprecedented number of generations within each family. For the first time in history, families comprise mostly the flesh and blood living rather than the fondly remembered and mourned.

Linder (1970) following Becker (1965) used conventional economic theory (along with its particular simplifying assumptions) to demonstrate that a logically inevitable consequence of economic growth was an increase in the shortage of time and a rise in its price. This takes us back to the contrast outlined earlier between the virtually unbounded character of society and the all too finite nature of individual human life spans. As the *social* range of available opportunities increases, choosing how best to enjoy them becomes more difficult, because an individual body can only be in one place at one time. However, the simplified model of ‘society’ used in such theories abstracts from both the variety of human life spans, their changing average length, and individuals knowledge of both their own age and these general facts.

While it is true that, as Keynes (1923) once remarked and is relentlessly quoted, ‘in the long run we are all dead’ this is true in two importantly different senses. First it draws attention to the inevitability of mortality in general in contrast to its unpredictability in particular. In the short run we are very much alive, but have little way of knowing, with precision, just where the boundary lies between ‘short’ and ‘long’. Mass maturity might define this boundary at the social, but never at the individual, level. Second, however, this aphorism highlights the fact that society or culture endure beyond the span of individual lives, introducing a fatal divergence between biography and history that not only marks a dividing line between individual and collective interests, but between the kind of thing that ‘society’ and the ‘individual’ are. We return to this issue below when we discuss the transversal and the longitudinal. It is also true that in the short to medium term, not only are far fewer of us dead, but we are aware of this fact, and can, to some extent, plan for it. While the ‘transversal’ opportunity cost of any activity or course of action at any point in time becomes higher, this must be set against an increasing ability to plan across a much longer life course. This situation is often described in terms of the rise of reflexivity and self-identity (Giddens 1991). It might also usefully be seen in terms of a trend increase in what Dahrendorf (1979) called ‘life chances’ created not only by the relentless expansion of the social division of labour, but also by longer lives across which to explore them.

The future of the family

The reproductive revolution, progressively frees sexual reproduction from normative or state regulation such as the prohibition of contraception or abortion. Legitimacy becomes less relevant. Along with the rise of personal autonomy, the expression of sexuality is gradually disconnected from reproduction, permitting the rise of ‘plastic’ sexuality (Giddens 1992) together with its vast commodification. Norms and values, such as those discussed within the debate over the ‘second demographic transition’ (Cliquet 1991; Coleman 2003; Lesthaeghe 1991; Van de Kaa 1990), change so as to re-define sexuality as a private matter over which the individual ought to be sovereign. The current legalization of homosexual marriage and moves to prevent discrimination on grounds of sexual orientation, together with the dismantling of legislation that regulated sexual activity (adultery, sodomy etc) and the transformation of sexual activity into something firmly in the realm of the ‘private sphere’ represent some of the final stages of this process.⁷ Marriage regulated by church or state declines, supplanted by cohabitation and what Davis once called ‘unconventionalised intimacies’ (Davis 1937). The substitution of the family by the state as the institution which serves as the ultimate guarantor of subsistence, and the replacement of the household by the labour market as the main institution governing production weakens the family from outside, while inside it is undermined by the increase in the force of liberalism and personal autonomy (de Singly 1993; Flaquer 1998). People’s status as citizen becomes progressively to supplant their status as family member (Mann 1994). At the same time as the family is socialised and hollowed out, it moves, paradoxically, towards the centre of politics, both as an object of state population policies, and as an institution charged with realising the rapidly expanding social rights of the infant, as well as their social obligations. This raises the question of the ‘survival’ of the family as the location of reproductive sexuality.

⁷ Once again, Spain serves as an example of exceptionally rapid change. A state that till 1978 required husbands to sign married women’s employment contracts now permits marriage between same sex couples on equal terms.

However it would be quite wrong to conclude from this, and from the atrophy of ‘gender’ that the family is destined to wither away. Rather it will assume a greater diversity of forms, all of which contain as their distinguishing feature the attempt (usually successfully realized) to maintain stable relations of attachment over time between at least one adult and an infant, and the later legacy of these relations in terms of feelings of love, mutual loyalty and obligation, or indeed, resentment hostility and alienation. Within all this vertical, generational relations between (grand)parents and (grand)children will continue to become *more* important than ‘horizontal’ relations between siblings, primarily because of the redistribution of reproductive labour, and its money costs, between parents and grandparents, and also because of the decline, along with fertility rates, of the absolute number of siblings and other relations within similar age cohorts. Mass maturity, paradoxically, strengthens and extends the family, in the simple but basic sense that more generations of any family are likely to be alive at any point in time, as we have already seen.

The state and the collectivization of reproduction

As we noted above, the male breadwinner system can sometimes be seen as an early attempt by states to regulate reproductive labour. As living standards rose, it became possible, for the first time in human history, to push the sexual division of labour in reproductive work to its limit such that women were largely confined to such work rather than other forms of production (Parsons 1956). This was especially the case where this development came before the generalization of domestic labour saving technology (running water, washing machines, gas or electric cookers, gas or electric heating etc) as in the Spain in the late 1950s and early 1960s, so that even within the reproductive revolution the volume of reproductive work increased. Elsewhere, such as the US, or Britain, where such technological innovation came earlier, women entered the labour market in increasing numbers from the 1900s (in the US) and the 1950s (in Britain) However this system quickly became a victim of its own success. As the efficiency of reproductive labour increased still further, women not only became freed to enter other areas of productive labour again, but were increasingly pushed there by the decline in the volume of domestic reproductive labour to perform. Moreover within a labour market

rather than a patriarchal household economy, they could do so on increasingly equal terms with men. The male breadwinner system flared like a candle before it died: a last flourishing of patriarchy before it entered its terminal decline. The industrial and economic crises that followed the oil shock of the 1970s has hastened the demise of the male breadwinner system (Oppenheimer 1994) and it is significant that often it is specifically younger men who have been denied access to a 'family wage' (Tigges 1991).

Because the revolution in efficiency of reproductive labour (as an 'input' to births) has been outpaced by technological progress elsewhere; because it requires much more time and effort to producing autonomous adults capable of contributing to a complex, highly rationalised, scientific knowledge-based society with an ever widening division of labour; and because parents wish to endow their children with the capacity to pursue their own, autonomous 'identity projects'; for all these reasons the transversal 'cost' of children (*relative to other current opportunities*) has appeared to rise, pulling the state further into the socialization of reproduction in the (misplaced) effort to arrest falling fertility rates. The eclipse of the male breadwinner system as a reproductive regime has produced the contemporary debate on 'work-life balance' or 'conciliation of work and family life', as states look to increase the labour supply both in the short term (more mothers in employment) and the long term (sustaining fertility by encouraging more workers to become parents). From the perspective of the reproductive revolution much of this debate appears misplaced, as it tends to overlook the wider context of falling fertility on the one hand, and underestimate the effort required to make parenting obligations fully compatible with employment across a the life course. (MacInnes 2005).

This is doubly ironic. States do not, in general, socialize the costs of childcare willingly. Compared to all taxpayers, workers or voters those who are currently parents of dependent children (and those children themselves) form a rather small (and decreasing) group, especially compared to those who are, or are confident of becoming, old enough to draw a pension (Myrdal 1968 [1939]). However states' fears of population decline lead them to look for measures to boost fertility. If states thus address a real issue for the wrong reasons, their likely solution, (pro-natalist policies based on socializing further the

costs of children through the extension of childcare services, fiscal transfers and subsidies to parents of dependent children) will, on past experience, have positive unintended effects on female and child poverty, but only insofar as they fail in their stated intention of increasing fertility rates (Folbre 1997).

The myth of population ageing and catastrophic population decline

The debate on population ageing (OECD 1990; World Bank 1994) largely turns upon the assertion that longer lifespans must mean an increase in the dependency ratio between those in productive employment and those who are not. However this oxymoronic term rests on a misleading metaphor characterising societies as individuals. Individuals do 'age', bringing a decline in their vital capacities and death. Societies, or 'populations' cannot and do not 'age'. The shape of their age pyramids may change, but ageing is a social as well as biological process, and one of the key results of the increase in the social forces of production has been an increase not just in average life expectancy, but in the standard of health and activity of people for any given calendar age. Sir Mick Jagger, for example, remains a sex symbol and rock star at an age which, a century ago, would have rendered him infirm had he been fortunate enough to survive at all. Once again, a longitudinal view corrects a mistaken transversal impression. We cannot determine the future capacities of the elderly by making transversal comparisons across *different generations* with different ages in the population at a point in time. Older people today are vastly different to their counterparts in earlier times from earlier generations. So too will be the elderly of the future.

What matters in dependency ratios is the balance, *over time and across generations*, between the productivity of those who work and the consumption levels of those who do not, as well as the relative size of these two groups. The productivity of the former will continue to increase. The consumption levels of the latter depend *inter alia* on the relative costs of maintaining retired and inactive people versus that of maintaining and educating those who have yet to enter the labour force. Insofar as the debate about population ageing is about concern over worsening 'dependency ratios' as the number of elderly inactive increases it is simply empirically mistaken. As we have seen the elderly take on

an increasing amount of reproductive work, which facilitates much higher rates of incorporation of prime age women in the labour market, as well as maintaining high rates of male participation despite trends towards equalization in the domestic and childcare sexual division of labour (thus improving rather than worsening dependency ratios). A paradoxical effect of the shift from gender to generation in the distribution of work is therefore that actual dependency ratios (in the sense of the relationship between those doing productive work and those dependent on them) come to have less and less to do with age, or the shape of age pyramids in a given society. A second paradox is that it is likely to be the *improvements* in the health, educational level, income and wealth of the elderly that lead to increases in their consumption of health and other services, as active assertive, and above all experienced, citizens. Finally, general productivity increases can be spread across rises in living standards and increases in the dependency ratio as long as they such increases are greater than that of the dependency ratio itself: something which has always been the case in the short to medium as well as the long term.

Yet perhaps more important than these effects, is the lack of any simple relationship between dependency and employment status. Young employees may carry heavy burdens of training or mortgage debt. The retired may possess substantial assets accumulated across the life course. And if we learn the key lesson of not drawing longitudinal conclusions from transversal comparisons, we may safely hypothesise that tomorrow's retirees will have accumulated more than today's. 'Population ageing' has, at least, contradictory implications for dependency ratios.

Once again we may take Spain as an example, where calculations taking an appropriately longitudinal perspective reveal a very different prospect for dependency ratios than the standard gloomy prognoses. Analysing synthetic cohorts constructed from a quarter century Labour Force Surveys, Garrido and Chulia estimate dependency ratios in Spain to *fall* 40% between 1985 and 2030 (2005 figure 6.2). Blanes et al (1995), also using longitudinal techniques, obtained similar results a decade earlier. Advancing activity rates for women and the fall in young dependents more than makes up for the rise in the number of older inactive people and later labour market entry.

Mass maturity and the reproductive revolution have been central to imparting an unprecedented dynamism to modern societies by revolutionising their reproductive efficiency and emancipating them from the eternal struggle against early death and wasted life. What other social progress bears comparison with the unprecedented prospect of a long and healthier life for almost all? A life that is freer in that it stretches well beyond the (reduced) obligations of the reproductive years. There is a well known strong statistical relationship between a states' affluence and the life expectancy of its citizens. Affluence has been assumed to confer longevity. However the reverse is also important: mass longevity facilitates affluence. How can it be, therefore, that such magnificent social progress comes to be seen as the social sclerosis summoned up by 'population ageing' rhetoric? Let us outline of two of our ideas. First such rhetoric is a convenient tool for those seeking rationales to restrict the welfare state, on the grounds that such sclerosis threatens future prosperity. Second, it comprises an unfortunate legacy from social sciences' flirtation with eugenicist ideas (Mackenzie 1981). From Malthus onwards demography has at times been distorted by an unfortunate tendency to see the right kind of early deaths as, in the long run, not only inevitable but even desirable.

Demography and the state

Demography as a discipline has to an extent a certain vested interest in 'population' 'problems' that it might hold out the possibility of understanding and solving. These 'problems' are those of the state. For example states looking for sufficient conscripts for their armies, or contributors to their tax or social security systems, or concerned to gauge the demand for their health or education services. It is no accident, for example, that the British Census had its roots in the Revolutionary War with France (the British Government wished to know how many men of fighting age it might have at its disposal) (Colley 1994), nor that demographers happily conceive of 'populations' in terms of the physical boundaries of states and legal definitions of citizenship. States have routinely feared population decline as leading in the short or long term to the erosion of their power (Teitelbaum and Winter 1985). And demographers have frequently solemnly clothed such fears with scientific respectability. They have done much the same with

complementary fears of an ‘alien’ population ‘explosion’ and the consequent impoverishment of the developing world: impoverishment that might, in the era of the cold war, nourish the growth of communism. But just as the dire predictions of population and national collapse in Europe in the 1930s and population and communist explosion in the South in the 1970s and 1980s proved mistaken, we should treat current predictions of dire European population decline with appropriate caution.

Let us make only three observations. First, the future of life expectancy increases is uncertain. While some argue that we are now approaching a biological limit such that the rate of future increases will progressively diminish (Olshansky, Carnes and Cassel 1990) others argue that such a limit is far from obvious (Wilmoth 1997; Wilmoth et al. 2000). However, as long as they continue, the ‘replacement level’ for fertility can lie below the oft-cited figure of 2.1 children per woman. This is graphically illustrated for Spain in Figure 3, which shows the difference between conventional reproduction measures and one based on Henry (1965), that is, the proportion of ‘person years’ being replaced.

Second, any problem of population ‘decline’ is a purely political one in the context of a planet whose population has almost trebled in the last half century. It is about state rather than personal potency. Third, ‘population ageing’ is curious way to label one of the greatest modern accomplishments of mankind: the ‘democratisation’ of the chances of enjoying a long, and lengthening lifespan, together with a reduction in the proportion of that span dedicated to reproductive labour, and especially ‘wasted’ reproductive labour: an anodyne phrase for what it represents – the emancipation of the vast majority of people either from their own early death or the trauma of witnessing the death of their child. Compared to the ugly fate of those ‘populations’ condemned to live in states still blighted by war, famine, disease and high child mortality, a fate all the more dreadful because readily avoidable, ‘population ageing’ is an achievement to be heartily wished for.

The transversal, the longitudinal and the demographic transition

Understanding the reproductive revolution requires us to understand not only the distinction between transversal and longitudinal approaches to measuring fertility (as in the comparison of period total fertility rates and cohort completed fertility rates) but also the distinction between ‘fertility’ and reproduction. Fertility is often taken directly as an indicator of reproduction (for example in the debate over fertility decline and population ageing or stagnation). However to consider reproduction actually requires us to examine the generational relation between *both* its components: fertility *and* mortality. This allows us to be both more cautious about the likelihood of imminent population decline, and also less certain about whether such population decline, should it ever occur, is something to be feared. ‘Population’ reductions might pose policy challenges to particular states, and alter the coefficients of their global power base. They pose no conceivable threat whatsoever to the reproduction of the species. Such a conclusion turns on the misuse of the term ‘population’ if transplanted too directly from biology to demography. Species may have populations. The earth has a human population. States have inventories of citizens, residents, those present within the territory who are not resident (a category significantly lacking from the standard terminology) and so on. To refer to such inventories as a ‘population’ is to apply a naturalistic term to what is a thoroughly social construct, determined by the extent to which states are able to monopolise control of territory, define citizenship or nationality, control migration and so on. This application is facilitated by a sociological imagination that substitutes the transversal for the longitudinal.

Let us conclude with some methodological and theoretical observations and reflections. The first concerns the disciplinary division of labour between sociology and demography. It is only because the links between these two disciplines have recently been so weak that the kinds of gaps in knowledge and distorted conceptualisations that we have discussed above can come about. Sociology ought to pay more attention to ‘reproduction’ in the sense of the supply of mortal human beings as well as to the reproduction of social ‘structures’ such beings might fill. Demography ought to pay more attention not only to the social relations within which the variables it tries to understand develop, but also to

the constellations of state power within which it has developed as a discipline (Hodgson 1983; MacInnes 2003).

The second concerns the relationship between the transversal and the longitudinal in any research that involves age as a variable. Demography has been developing the methodological and theoretical implications of such a distinction for decades. Sociology would do well to take this up (Lèvy 1993; Riley 1997).

Insofar as it has led to a world in which people have a more limited direct experience of the death of relatives or others they know personally and in which such experience occurs later in life, the reproductive revolution has helped contribute to the elaboration of a specifically transversal '*sociological* imagination' of societies, imagined as 'flat' self-reproducing structures which move through time, and in which the question of which particular individuals comprise a given population is for practical purposes irrelevant. Private trouble, to use Mills' formulation, is simply the microcosm of public issue. Thus, for example, the population of Spain in 2004 can be compared with that of 1994 or 1904, as if it were a matter of comparing something with a common element: Spanish society in 2004 with Spanish society in 1994. The sociological imagination effortlessly (and, we suspect, largely unconsciously) transforms longitudinal flows into transversal stocks. Thus, e.g. we might observe that population has 'grown' by x thousand, or that the working class has grown smaller or that a greater proportion of fathers are changing nappies and so on. Were we to assume that social self reproduction were perfect, that 'Spain' in its 2004 edition was essentially similar to 'Spain' in its 1994 (or for that matter 1904) edition, and that individuals were either immortal or entirely socially constructed, then this would not matter, because we would simply be measuring the 'same' social units at different points in time. It would not matter if we used (for example) the experience of those who are currently 'middle aged' in a cross sectional survey to represent either the future experience of the young or past experience of the old, or represent the life course as the progression from the experience of the currently young to the currently old. But since the *raison d'être* of sociology is precisely the need to

understand the ‘constant revolutionising’ of modern society, this is an unhelpful, if not self-defeating assumption.

This is not just because the confusion of the transversal and longitudinal yields empirically misleading results, although it certainly does do that. For example the total fertility rate, much cited in debates about population decline and population ageing, routinely overestimates fertility decline in contemporary Europe because it assumes (as any transversal measure must to) that the best estimate of the behaviour of a given age group in the future is the repetition of the current behaviour of those of that age. It is because this confusion makes a simplifying assumption about the nature of social relations that is at once analytically crippling and politically convenient.

Social relations are promiscuous across both time and space. Writing, and later mechanical reproduction, allow the long dead to communicate with the yet to be born. Our descendants will still be able to read the works of Plato. Everywhere. However for practical purposes it is often impossible to think of ‘society’ in terms of the global historical existence and evolution over time of civilization, or of ‘history’ as the manifold imaginings of the nature key aspects of the past must have assumed in order to give rise to social relations as we know them now. It has therefore been easier to think in terms of ‘societies’ with relatively discrete histories and diverse contemporary structures. It has been easier still to align the spatial boundaries of these societies with the contemporary states. Population metamorphoses into states’ *populations*.

The demographic transition is based on transversal measures, while the concept of a reproductive revolution adopts a consistently longitudinal perspective, based on generational demographic indicators. This is decisive. In the demographic transition, mortality and fertility are not ‘real’ in the sense of phenomena actually experienced by any actual group of people, and take account neither of the passage of time in the life course nor the effects of changing mortality levels on peoples’ actual lives.

‘Reproduction’ is the reproduction of ‘stocks’ as it were, rather than the reproduction of lives. That is why the issue of whether mortality falls produce lower fertility, and if so,

what are the mechanisms which link the two phenomena remain unresolved. The demographic transition takes the form of an empirical generalization rather than a theory in the proper methodological sense of the term, because the transversal measures it uses cannot go beyond this. In fact, it has been shown that mortality declines do not always precede fertility falls, as happened for example in Catalonia. It does not establish causal mechanisms that demonstrate how mortality falls produce a demographic transition. On the contrary, the concept of the reproductive revolution is a 'theory' in that it specifies causal mechanisms and directions. The demographic transition account is 'exogenous' to demography and depends upon rather general concepts of development and modernization. However the concept of a reproductive revolution can be developed within demographic terms that are themselves quantifiable.

Individuals may aspire to ubiquity, but find their lives anchored in a material body confined to only one place at any one time and limited, even after the reproductive revolution, to a lifespan that may be of unknowable duration but is definitely finite. Their sense of self, identity or agency resides in their ability to think of their lives in terms of a biography over which they have determination, but not control. In a disenchanted era, they may discard a view of their lives in terms of fate, calling, God's will or the push and pull of nature or super-nature, and seek instead to understand it in terms of the collision of their individual agency with the legacy of history and agency of others. This is, of course, a Herculean task. Little wonder that Weber could use such terms as 'unprecedented inner loneliness' (Weber 1930) to describe the soul of those with 'no choice but to choose' (Weeks 1995). Moreover, that same Enlightenment and rise of scientific rationalization that dethroned God also demanded (in theory if not in practice) that men and women henceforth make history in a way that respected each other's agency, forcing social order to contend with liberty. One way to simplify this task has been to appeal to the old bases of order and structure: nature and faith. These may be and remain surprisingly effective strategies, but in the longer term run up against the problem that since the will of God or nature rests upon human interpretation, they merely project the making of a choice onto others.

Another way to simplify this task has been the sociological imagination. Perhaps in the absence of Divine or Natural laws, men and women might discover ‘social’ laws to guide their understanding of social action and consequence. But this imagination can actually obscure the processes of social change if it is exercised in too simple a form, giving us over socialized conceptions of people (Wrong 1961) whose life courses are read off from transversal data or ‘snapshots’ at a given point in time of what is imagined to be social structure. Thus a major challenge posed to sociology in understanding the reproductive revolution is to develop ways of imagining or theorizing society that enable us to see the longitudinal more clearly, and see the construction of the social through the prism of the development over time of biographies, constructing the transversal from the longitudinal, rather than *vice versa*.

Conclusions

This article has suggested a new concept for understanding the nature of demographic change in modern societies, arguing that adopting a longitudinal rather than transversal perspective reveals the existence of a one-off change in the efficiency of the reproductive system (considered in its simplest form as the relation of the number of births per woman to population level) which has been fundamental to the rise of modernity. It has argued that recognising this has profound implications for how we view such issues as declining fertility, population ageing, the evolution of the family, the role of the state, gender change and the distribution of work (both productive and reproductive, paid and unpaid) across the life course and between men and women. We believe it also has an important role to play in many other debates, such as progressive deregulation of sexuality (including the legalisation of homosexual marriage); the sociology of age and the life course; the evolution of the intergenerational transfer of wealth and other forms of capital (and the competition between the state and the family to control it); the economics of time and that whole tradition of sociology that seeks to establish links between modernisation, broadly conceived, secularisation and changing values. If we think in terms of the ‘quality’ as well as ‘quantity’ of children, then the evolution of the reproductive revolution is central to states’ concerns to improve competitiveness in a globalising, knowledge-based economy. It also has methodological and theoretical

implications for both sociology and demography. Rather than repeat the specific conclusions in each of these areas reported above, let us try to reflect briefly on two considerations with wider significance.

Because of its concern with vital statistics, demography has always had a commitment to longitudinal techniques, whose simplest form is, after all, the life table. This is a commitment sociology would do well to embrace. It is, after all, a central irony that a science which sets out to explain and understand social change, should use transversal techniques whose capacity to say anything about the life course is predicated precisely on the absence of such change! Longitudinal approaches can be cumbersome and costly, but technical innovation has brought them within much easier reach than only a few years ago.

Enduring revolutions are about change that is not only rapid but popular, not only because it affects the mass of the population, but because they themselves are its protagonists. So it has been with the reproductive revolution. Like all truly fundamental historical revolutions it has had no leader, but rather been driven forward by a range of discrete activities by countless anonymous social actors. No Robespierre or Lenin has inspired or led it. No manifesto has proclaimed its aims. No armies have fought under its banner. What has happened rather, is that the mass of ordinary people, in the course of their everyday activities have found ways to emancipate themselves from the demographic straitjacket of the past, discovering in turn, that such emancipation opens up for them hitherto unimagined freedom of manoeuvre in their lives, including the freedom to devote more time and resources to the rearing of their children within a much longer lifespan, or, alternatively, the freedom to delay becoming a parent till an age they would in earlier centuries have been lucky to survive to, or again to avoid becoming a parent at all. Not only has this process included a virtuous temporal circle, in which increased reproductive efficiency quickly released the potential to develop it still further in succeeding generations, it has, thanks to migration, trade and communications, exploded globally. Should the developed world contemplate the continued waste of life and toll of early deaths taken by the failure to complete the reproductive revolution in countries of

the South ravaged by poverty and disease, then in ages to come, people will have every reason to judge the 21st century harshly.

References

- Alberdi, Inés, and Natalia Matas. 2002. "La violencia doméstica: Informe sobre los malos tratos a mujeres en España." in *Colección Estudios Sociales no 10*: Fundació La Caixa.
- Anderson, Benedict. 1991. *Imagined Communities*. London: Verso.
- Baumol, William J. 1967. "Macroeconomics of unbalanced growth: the anatomy of urban crisis." *The American Economic Review* 157: 415 - 426.
- Beck, Ulrich, A. Giddens, and S. Lash. 1994. *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*. Cambridge: Polity.
- Becker, Gary S. 1965. "A Theory of the Allocaton of Time." *The Economic journal* 75:493-587.
- . 1991. *A Treatise on the Family*. Cambridge, Mass.: Harvard University Press.
- Blanes, A., Gil, F. and Pérez, J. 1996. Población y actividad en España: evolución y perspectivas. Colección Estudios e Informes Número 5. Barcelona: Caja de Ahorros y Pensiones de Barcelona.
- Bowlby. 1971. *Attachment and Loss. Vol. 1: Attachment*. Harmondsworth: Penguin.
- Cabré i Pla, Anna. 1979. "Reflexions sobre l'evolució de la població a Catalunya fins a l'any 2000." Pp. 11-36 in *Catalunya cap a l'any 2000*, edited by FUNDACIÓ JAUME BOFILL. Barcelona: Editorial Blume.
- . 1989. "La reproducció de les generacions catalanes. 1856-1960." Departament de Geografia. Facultat de Lletres. Universitat Autònoma de Barcelona.
- Cabré Pla, Anna. 1999. *El sistema català de reproducció. Cent anys de singularitat demogràfica*. Barcelona: Ed. Proa, Col. "La mirada".
- Centre for Longitudinal Studies. 2004. "Millennium Cohort Study First Survey 2001-2003[computer file] 2nd Edition. February. SN: 4683. University of London. Institute of Education." Colchester, Essex: UK Data Archive [distributor].
- Cliquet, Robert V. 1991. "The second demographic transiton: fact or fiction." in *Populations Studies*. Strasbourg: Coucil of Europe.
- Coale, A., and Paul Demeny. 1983. *Regional Model Life Tables and Stable Populations (Ed 2^o)*. New York: Academic Press.
- Coale, A.J. 1986. "The Decline of Fertility in Europe since the Eighteenth Century As a Chapter in Demographic History." Pp. 1-30 in *The decline of fertility in Europe : the revised proceedings of a Conference on the Princeton European Fertility Project*. Princeton, N.J.: Princeton University Press.
- Colemn, David. 2003. "Why we don't have to believe without doubting in the 'Second Demographic Transition': Some agnostic comments." Paper to the European Population Conference, Warsaw 2003.
- Colley, Linda. 1994. *Britons: Forging the Nation 1707 - 1807*. London: Pimlico.
- Connell, Robert W. 2002. *Gender*. Cambridge and Oxford: . Polity Press in association with Blackwell Publishers ltd.
- Craib, Ian. 1994. *The Importance of Disappointment*: Routledge.
- Dahrendorf, Ralf. 1979. *Life Chances*. Chicago: Chicago University Press.
- Davis, Kingsley. 1937. "Reproductive Institutions and the Pressure for Population." *The Sociological Review* XXIX:284-306.

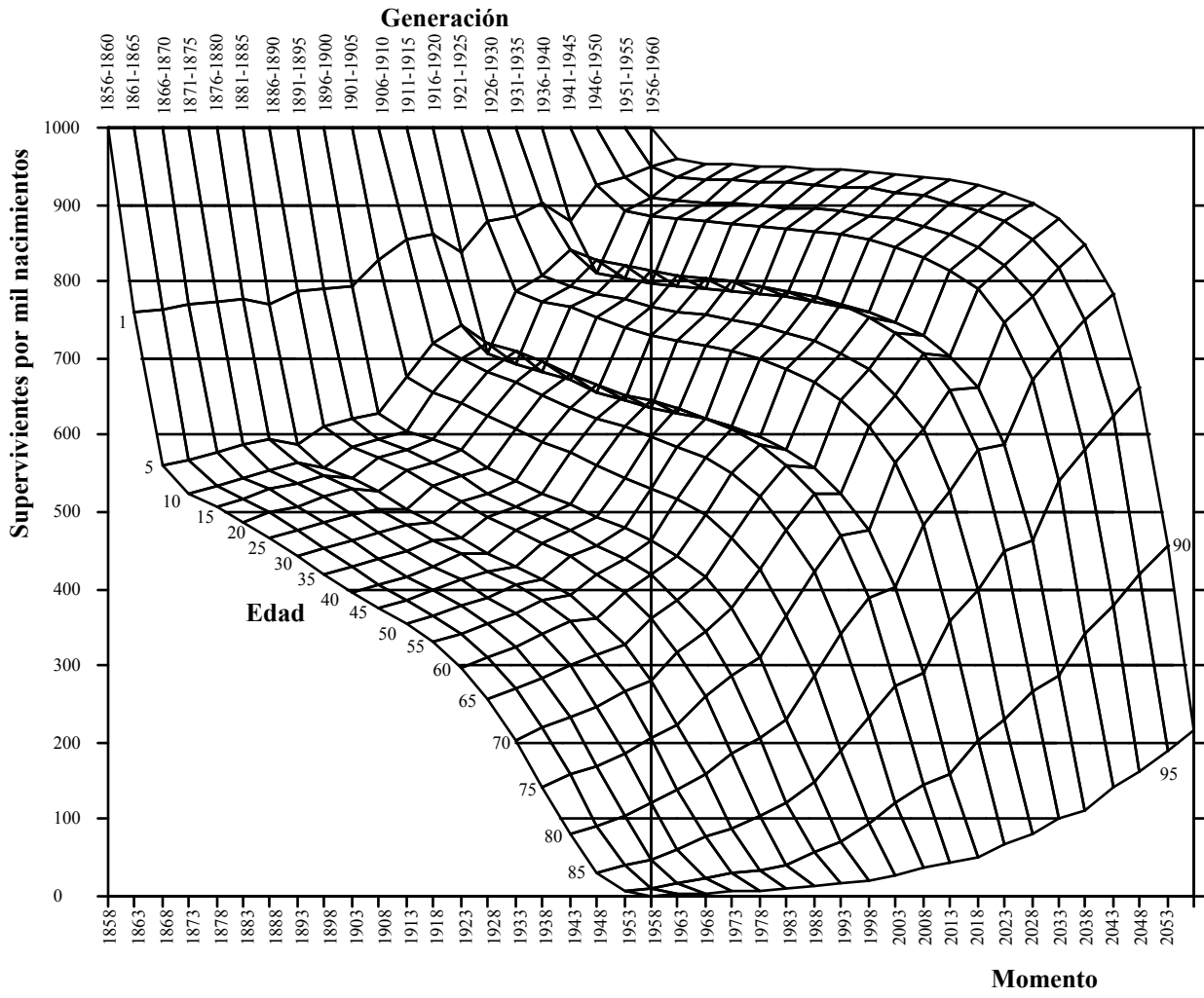
- de Singly, François. 1993. *Sociologie de la famille contemporaine*. Paris: Nathan.
- Devolder, D. 2005. "L'infécondité volontaire en Europe, ses causes et conséquences prévisibles: une étude comparative." Bruxelles: European Commission.
- Dinnerstein, Dorothy. 1987. *The Rocking of the Cradle and the Ruling of the World*. London: Women's Press.
- Dobash, R. Emerson, and Russell P. Dobash. 1992. *Women, violence and social change*. London: Routledge.
- Elshtain, Jean Bethke (Ed.). 1982. *The Family in Political Thought*. Brighton: Harvester.
- Fernández Cordón, J.A. 1995. "La reproducción de las generaciones españolas." in *IV Congreso de la ADEH*. Bilbao 20-22 de septiembre: Borrador provisional.
- Fernández Cordón, Juan Antonio. 1977. "Étude Démographique de la Fécondité en Espagne (1922-1974)." Université de Paris I.
- . 1986. "Análisis longitudinal de la fecundidad en España." Pp. 49-75 in *Tendencias demográficas y planificación económica*, edited by Alberto Olano. Madrid: Ministerio de Economía y Hacienda.
- Festy, Patrick. 1997. *La fecondité des pays occidentaux de 1870 a 1970*. Paris: INED-Presses Universitaires de France. Travaux et Documents, Cahier n° 85.
- Filmer, Sir Robert. 1991 [1680]. *Patriarcha and other writings*. Edited by J.P. Sommerville. Cambridge: Cambridge University Press.
- Flaquer, Lluís. 1998. *El Destino de la Familia*. Barcelona: Editorial Ariel, S. A.
- Folbre, Nancy. 1997. "The Future of the Elephant Bird." *Population and Development Review* 23:647-654.
- Garrido, Medina, Luís. 1992. *Las dos biografías de la mujer en España*. Madrid: Ministerio de Asuntos Sociales: Instituto de la Mujer.
- . 1996. "La revolución reproductiva." Pp. 205-238 in *Salud, dinero y amor. Cómo viven las mujeres españolas de hoy*, edited by Cecilia Castaño and Santiago Palacios. Madrid: Alianza.
- Garrido Medina, Luís and Chuliá Rodrigo, Elisa. 2005. *Ocupación, Formación y el Futuro de la Jubilación en España*. Colección Estudios Número 173. Madrid: Consejo Económico y Social.
- Gershuny, Jonathan I. 1992. "Change in the Domestic Division of labour in the UK, 1975 - 87: dependent labour versus adaptive partnership." in *Social Change in Contemporary Britain*, edited by N. Abercrombie and A. Warde. Cambridge: Polity Press.
- Gershuny, Jonathan I. , and Kimberly Fisher. 2000. "Leisure in the UK Across the 20th Century." in *Twentieth-century British social trends*, edited by A. H. Halsey and J. Webb. London: Macmillan Press.
- Giddens, A. 1992. *The Transformation of Intimacy: Love Sexuality and Eroticism in Modern Societies*. Cambridge: Polity.
- Giddens, Anthony. 1991. *Modernity and Self Identity*. Cambridge: Polity.
- Gil Calvo, Enrique. 1991. *La Mujer Cuarteada*. Barcelona: Anagrama.
- Goode, William J. 1964. *The family*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Henry, Louis. 1965. "Reflexions sur les taux de reproduction." *Population*:53-76.
- Hobbes, Thomas. 1991 (1651). *Leviathan*. Cambridge: Cambridge University Press.
- Hobsbawm, Eric J. 1962. *The age of revolution: Europe 1789 - 1848*. London: Weidenfeld & Nicholson.

- Hodgson, D. 1983. "Demography as social science and policy science." *Population and Development Review* 9:1-34.
- International Social Survey Programme. 2004. "Family and Changing Gender Roles III, 2002. [computer file] 1st edition, ZA3880;UK Data Archive SN5018." Köln: Zentralarchiv Für Empirische Sozialforschung. Colchester, Essex: UK Data Archive[distributor].
- Jamieson, Lynn. 1998. *Intimacy : personal relationships in modern societies*. Cambridge: Polity.
- Kelly, Elizabeth, and Jill Radford. 1987. "The Problem of Men: Feminist Perspectives on Sexual Violence." in *Law, Order and the Authoritarian State*, edited by Phil Scruton. Buckingham: Open University Press.
- Kessler, S. J., and W. McKenna. 1978. *Gender an Ethnomethodological Approach*. New York: Wiley.
- Keynes, J. M. 1923. *A tract on Monetary reform*.
- Lee, R. D. 2003. "Rethinking the evolutionary theory of aging: Transfers, not births, shape senescence in social species." *Proceedings of the National Academy of Sciences of the United States of America* 100(16):9637-9642.
- Lesthaeghe, Ron. 1991. *The second demographic transition in Western Countries: an interpretation*. Brussels: Princeton University Library.
- Lévy, M. L. 1993. "Spécificité de la démographie: l'analyse "longitudinale"." *Population & Sociétés* 284:1-3.
- Linder, Staffan Burenstam. 1970. *The Harried Leisure Class*. New York: Columbia Univeristy Press.
- Livi Bacci, M. 2001. *A Concise History of World Population (3rd edition)*. Oxford: Blackwell.
- MacInnes, John. 1998. *The End of Masculinity*. Buckingham: Open University Press.
- . 2003. "Sociology and Demography: a Promising Relationship?" in *Edinburgh Working Papers in Sociology No. 23*. Edinburgh: University of Edinburgh.
- . 2005. "Work-Life Balance: Response to the Baby-bust or Reward for the baby Boomers?" *European Societies* 7.
- . 2006. "Category and comparsion across what kind of frontier?" in *Proceedings of the Third International Workshop on Comparative Survey Design and Implementation 2005. Zentrum fur Umfragen Methoden und Analysen Nachrichten Spezial Vol 11*.
- Mackenzie, Donald. 1981. *Statistics in Britain, 1865-1930: The Social Construction of Scientific Knowledge*. Edinburgh: Edinburgh University Press.
- Malinowski, Bronislaw. 1927. *Sex and repression in savage society*. London: K. Paul, Trench, Trubner.
- Mann, Michael. 1994. "Persons, Households, Families, Lineages, Genders, Classes and Nations." Pp. 177 - 194 in *The Polity Reader in Gender Studies*. Cambridge: Polity Press.
- McDonald, Peter. 2000. "The "Toolbox" of Public Policies to Impact on Fertility - a Global View." in *Low fertility, families and public policies*. Sevilla.
- Meillassoux, Claude. 1981. *Maidens, meal, and money : capitalism and the domestic community*. Cambridge: Cambridge University Press.
- Mills, C. W. 1959. *The Sociological Imagination*. New York: Oxford University Press.

- Morgan, Patricia. 1995. *Farewell to the Family?* London: IEA Health and Welfare Unit.
- Myrdal, Alva. 1968 [1939]. *Nation and Family*. Cambridge Mass.: M.I.T Press.
- OECD. 1990. "El envejecimiento demográfico. Consecuencias para la política social." in *El futuro de la Protección social y el envejecimiento de la población*, edited by Ministerio de Trabajo y Seguridad Social. Madrid.
- Olshansky, S. J., B. A. Carnes, and C. Cassel. 1990. "In search of Mathuselah: estimating the upper limits to human longevity." *Science* 250:634-640.
- Oppenheimer, V. K. 1994. "Womens Rising Employment and the Future of the Family in Industrial-Societies." *Population and Development Review* 20:293-342.
- Parsons, Talcott. 1956. "The American Family: Its Relations to Personality and to the Social Structure." in *Family socialization and interaction processes*, edited by Talcott Parsons and Robert F. Bales. London: Routledge and Kegan Paul.
- Pateman, Carol. 1988. *The Sexual Contract*. Cambridge: Polity.
- Pérez Díaz, J. 2001. Transformaciones sociodemográficas en los recorridos hacia la madurez. Las generaciones españolas 1906-1945. Tesis doctoral. Madrid: UNED.
- . 2003. "Feminización de la vejez y Estado del Bienestar en España." *Revista Española de Investigaciones Sociológicas* 104:91 - 122.
- . 2003. *La Madurez de Masas*. Madrid:IMERSO.
- Requena, Miguel. 1997. "Sobre el calendario reproductivo de las mujeres españolas." *Revista Española de Investigaciones Sociológicas* 79:43'79.
- Riley, N. E. 1997. "Gender, power, and population change." *Population Bulletin* 52:2-&.
- Rubin, Gayle. 1977. "The traffic in women: Notes on the political economy of sex." in *Towards an Anthropology of Women*, edited by R. R. Reiter. New York: Monthly Review Press.
- Segal, Lynne. 1987. *Is the Future Female*. London: Virago.
- Teitelbaum, Michael S., and Jay M. Winter. 1985. *The Fear of Population Decline*. Orlando, Florida: Academic Press.
- Thompson, Warren S. 1929. "Population" in *American Journal of Sociology*. Vol. 34 no. 6 pp. 959 - 975.
- Tigges, L. M. 1991. "The Class Basis of Generational Conflict in the 1980s: Analysis and Critique of the Ageist Agenda." *Journal of Aging Studies* 5:1-18.
- Turner, Bryan S. 1996. *The body and society: explorations in social theory*. London: Sage.
- Van de Kaa, D. 1990. "The second demographic transition revisited: Theories and expectations." in *Population Change and European Society*. European University Institute, Florencia.
- Weber, Max. 1930. *The Protestant Ethic and the Spirit of Capitalism*. London: Allen and Unwin.
- . 1978. *Economy and Society: An outline of intepretative sociology*. Los Angeles: University of California Press.
- Weeks, J. 1995. *Invented Moralities*. Cambridge: Polity.
- Wilmoth, J. R. 1997. "In Search of Limits." Pp. 38-64. in *Between Zeus and the Salmon: The Biodemography of Longevity*, edited by K.W. Wachter and C.E. Finch. Washington, DC: National Academy Press.
- Wilmoth, J. R. y Horiuchi, S. 1999. "Rectangularization Revisted: Variability of Age of Death Within Human Populations", in *Demography*, 36 (4): 475-496.

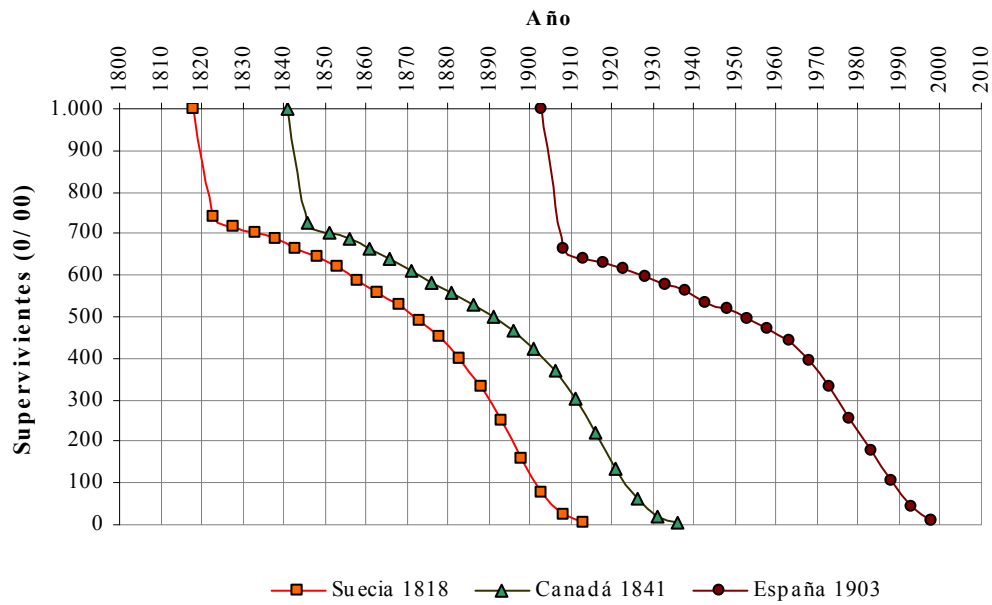
- Wilmoth, J. R., L. J. Deegan, H. Lundstrom, and S. Horiuchi. 2000. "Increase of maximum life-span in Sweden, 1861-1999." *Science* 289:2366-8.
- Winnicott, Donald W. 1965. *The Maturation Processes and the Facilitating Environment*. London: Hogarth Press.
- van Wissen, L. J. G. y Dykstra, P. A., (Eds). 1999. *Population Issues. An interdisciplinary Focus*, New York, Kluwer Academic/Plenum Publishers.
- World Bank. 1994. *Envejecimiento sin crisis. Políticas para la protección de los ancianos y la promoción del crecimiento*. Washington D.C.: World Bank.
- World Health Organisation, (WHO). 2004. *Maternal Mortality in 2000*. Geneva: WHO.
- Wrong, Denis. 1961. "The oversocialized conception of man in modern sociology." *American Sociological Review* 26:183-93.

Figure 1. Spain: Survival curves for women by generation 1856-1960



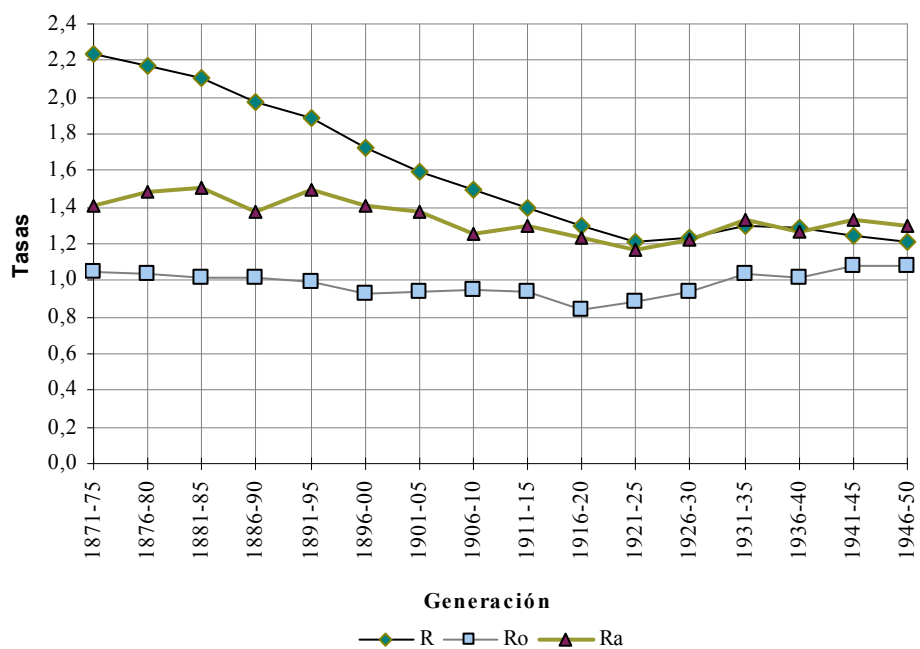
Source: Data taken from Cabré Pla, A. (1999), *El sistema català de reproducció. Cent anys de singularitat demogràfica*, Barcelona, Ed. Proa, Col. "La mirada".

Figure 2 Survival curves by age for the first generations to reach 'mass maturity' in Sweden, Canada and Spain.



Source: Pérez Díaz, J. (2002: 16).

Figure 3 Evolution of gross and net reproduction rates, and reproduction of years of life. Spain by generation 1871-1950.



Fuente: (Cabré i Pla 1989)

Nota: R (Gross reproduction rate) average number of daughters per woman.

R_0 (Net reproduction rate); average number of daughters per woman who reaches fertile age.

R_a (Rate of reproduction of years of life).