Coping with Time

Using a local time-path calendar to reduce heaping in durations

Karen Haandrikman, N. V. Rajeswari, Inge Hutter and B. M. Ramesh

ABSTRACT. Reproductive health surveys often face difficulties in measuring age and durations. Heaping is the phenomenon that certain dates, ages or durations are over- or underrepresented. Following the calendar method used in several Demographic and Health Surveys, the current research proposes the use of a local time-path calendar, based on time perceptions of women in South India. The objective of the calendar is to reduce heaping in the durations of postpartum amenorrhoea, breastfeeding, postpartum abstinence, and contraceptive use. The interviewer takes the respondent back in time using the local calendar; the memory of respondents is triggered by relating events to Indian festivals and other landmarks in the lives of people, enabling them to reply in their own time perspective. The method was tested in 2000 in a survey in South India; the findings indicate significantly less duration heaping. KEY WORDS • calendars • heaping • time

Introduction

Retrospective data collected in surveys in developing countries is often affected by memory problems and heaping. According to Ewbank (1981: 88), age misreporting is 'one of demography's most frustrating problems'. One way of dealing with heaping is to improve the design of questionnaires, mainly through calendars, which are used to help respondents to date events. This method is used in several Demographic and Health Surveys (DHS). The purpose of this article is to test the hypothesis that using a local, time-path calendar based on

VOL. 13 No. 2/3 (2004), pp. 339–362 0961-463X DOI: 10.1177/0961463X04045476
www.sagepublications.com

time conceptions of the local population can prevent heaping in duration data. The method is developed on the basis of theory on time dimensions and the time perceptions of the local population (Haandrikman, 2001). This article discusses ways to deal with heaping (see for instance Ewbank, 1981), theoretical dimensions on time (De Bruijn, 1999; Mills, 2000a), and the influence of calendars on (the measuring of) life events (Mills, 2000a). The local time-path calendar is developed in the context of a rural area in South India, where a survey was conducted to test the method. In the research area the Hindu calendar, based on full and new moon days, is used as the basis for time reckoning.

One of the problems often found in retrospectively collected data is heaping, the phenomenon whereby dates or ages are overrepresented, ending in zero or five. Heaped distributions of ages or durations usually do not represent the actual behaviour of people, but represent misreported data. Differences in attitudes towards age or duration, for instance caused by the relative unimportance of knowing someone's age, may effect reporting of age and duration.

Many researchers have distinguished different time dimensions, such as historical, social or process time. An important time dimension in this article is social time, a time perspective in which the behaviour of people is guided by rules and norms for relations with other people. The time frame that people have may influence their daily life in a direct manner: Time may impact life course events, like marriage or births. We argue that a time perspective also has an impact on the measurement of time.

A calendar may be seen as an expression of a time perspective, which means we can understand time perspectives by studying the different calendars that people use in their daily lives. Often many calendars are used simultaneously, such as the Gregorian calendar and the Hindu calendar. Calendars may determine events by indicating auspicious and inauspicious dates or years for events such as marrying, having sexual intercourse or buying a computer. In this way calendars influence life events. We hypothesize, that a local time-path calendar, in this case based on festivals and full and new moon days, allows people to think in their own time frame. It is argued that by using a local time-path calendar, duration heaping can be reduced.

A small-scale survey was conducted in February 2000 in the Dharwad district, Karnataka, India. Data were collected among 61 women, including 65 completed birth intervals. The study population included mainly illiterate women living in a rural district. In this area a detailed census (Rajeswari and Hutter, 1998) and reproductive health survey (see Hutter, Rajeswari, Hallad and Ramesh, 1999) had been conducted in the late 1990s.

The local time-path calendar is based on the Hindu calendar and includes local events and festivals. We expect that when people are triggered to relate events to the time system they use, they will be more precise in reporting. The interviewers ask questions on durations by taking the respondents through time

by mentioning local reference points. From the survey, two types of duration were distinguished: Reported and estimated durations. Both durations pertain to the same women. *Reported duration* results from the answer to the question about the length of the durations of postpartum amenorrhoea, breastfeeding, postpartum abstinence, and contraceptive use. The *estimated duration* arises out of the measurement of these durations with the local time-path calendar.

Moreover, we expect that a difference in reporting might occur among women from different socio-economic backgrounds. The study population is divided in two groups of women: Educated, more urbanized respondents, and lower educated, more geographically isolated respondents. We expect that higher educated women report less heaped durations than lower educated women, based on the idea that the former group has more access to and a better understanding of time devices and calendars than the latter group. Because of this better understanding, we expect them to be more precise in reporting.

Heaping

In this article we propose a new method to prevent heaping in retrospectively collected data. Heaping usually occurs in the process of collecting and compiling large amounts of data, especially in developing countries. It is well known that retrospective data collection is hampered by memory or recall problems of past life events, resulting in misreporting (Mills, 2000a). Heaping is one type of misreporting, and is often the result of respondents giving incorrect – although often not intentionally – information to the researcher (Myers, 1993). Age heaping or digit preference is the phenomenon whereby dates or ages are overrepresented, ending in zero or five. Ewbank (1981) defines age heaping as the tendency for enumerators or respondents to report certain ages instead of others. According to Shryock and Siegel (1976), 'the causes and patterns of digit preference vary from one culture to another, but preferences for ages ending in 0 or 5 is quite widespread' (p. 115). Socially or legally elevated heaping also occurs, for example marriage at age 18 because this is the legal age of marriage. Similarly, more than half of the women interviewed in the survey by Hutter, Rajeswari, Hallad and Ramesh (1999) reported that they reached menarche at the age of 12, because this is the socially accepted age to reach maturity. The phenomenon of duration heaping may be caused by respondents' rounding of lengths of periods, when duration data is collected by episode-based questionnaires. Examples of duration heaping in reproductive health surveys are heaping in the duration between menarche and (consummation of) marriage, marriage and first child, two births, but also the duration of postpartum amenorrhoea, breastfeeding, postpartum abstinence and use of contraceptives. In retrospective surveys, the data on duration of postpartum amenorrhoea is often of

poor quality, with gross heaping on multiples of six months (Potter and Kobrin, 1981; Ford and Kim, 1987). According to Lesthaeghe and Page (1980) rounding errors often lead to heaping at 3, 6, 12, 18 or 20 and 24 months with retrospectively reported durations. It should be taken into account that the effect of interviewers on data quality should also not be underestimated, according to Ewbank (1981). The educational level of interviewers as well as their previous experiences and supervision of interviewers may have a great impact on the quality of age reporting.

Why is heaping important? Age heaping is an important marker of poor data quality. A standard way to evaluate data is to check the extent to which age or duration heaping occurs. A high level of heaping is connected with poor data. Moreover, errors in reported age distributions, such as heaping, have an effect on the estimation of fertility and mortality rates (Ewbank 1981).

Misreporting is often connected with age, sex, and social and cultural perceptions of time. Knowledge of someone's age is a culturally controlled phenomenon (Scott and Sabagh, 1970). Perceptions of time are closely linked with the internal rhythm of people, but responses to time are culturally conditioned (Zerubavel, 1981). Examples of factors influencing the knowledge of age within a society are the celebration of birthdays, the use of birth certificates and the custom of the accurate calculation of the passage of time. When the knowledge of someone's age is not important, misreporting arises. Differences in attitudes to age strongly condition the accuracy of age reporting (Jowett, 1992). The accuracy of information also depends on the relative importance of events. Sorokin and Merton (1990/1943) argue that an event or a specific period is associated with a meaning when a certain extent of significance is attributed to it. An example from India will illustrate this. In India, the celebration of birthdays is not a common phenomenon, whereas the celebration of the menarche of a girl is (as a rite of passage) extensive. In the survey by Hutter, Rajeswari, Hallad and Ramesh (1999), 75 percent of the women interviewed reported that a special ceremony called *aarti* was conducted for them when they reached menarche. Collection of data on age at marriage may in general be rather difficult, but in an earlier survey in the research area (Hutter, 1994) the age at marriage was easy to collect since it was easy to remember for the respondents when it was related to menarche: Most women know the exact duration between menarche and marriage.

One approach to avoid heaping in duration data is to rely on current status data, and avoid retrospective data (Potter and Kobrin, 1981). However, most data are collected retrospectively; when heaping is found in the data, it is 'treated' afterwards. Several techniques have been proposed, which measure the amount of digit preference and try to correct for heaping (for instance, the Myers method, the Blended method, and Whipple's Index; Srinivasan, 1980; Jowett, 1992; Myers, 1993). Among the most frequently used indexes is the

Whipple's Index, which we will briefly describe here. The Whipple's Index evaluates the degree of (age) heaping in a population and is usually calculated as the sum of numbers at ages (or durations) ending in zero or five, divided by 1/5 of the total population in the same age range. If a population has perfect age reporting, and displays no large changes in fertility, mortality and migration for a long time, the index is 100. In general, distributions with a Whipple's Index below 105 can be considered as of very high data quality. The higher the index, the more heaping is present in the distribution under study. The United Nations has published a scale for estimating the reliability of data in virtue of the Whipple's Index. If the index is over 175, the quality of data is said to be very 'rough' (Newell, 1988).

However, the major efforts at improving distorted age distributions have been aimed at improving the design of questionnaires, mainly through the use of historical events calendars, which are used to help respondents date events (Ewbank, 1981). In large-scale retrospective sample surveys on fertility and mother and child health in developing countries, such as Demographic and Health Surveys (DHS), emphasis is put on consistency of information; various methods, such as historical or local calendars, are used to obtain for example a birth date in case the mother does not know the exact month or year. The teams in the field receive immediate feedback to improve data collection (Boerma, 1996). In several DHS, a calendar method is used in the individual questionnaire. Interviewers use an open questioning approach, in which they construct a woman's contraceptive history through a series of unstructured questions that relate events to other events in the calendar. They might ask: 'How long after the birth of X did you start using this contraceptive method?'. The interviewers receive training on probing techniques but are free to ask the questions in whatever way is most appropriate.[1] Freedman et al. (1988) developed a life history calendar that is widely used by researchers in the field. This calendar is said to improve the quality of retrospective data collection via the facilitation of visual and mnemonic timing of various life events. A calendar-based framework is used to provide a basic reference point for events. Events are more easily remembered and serve as temporal or mnemonic markers for other questions. For interviewers, the advantages are that the calendar helps them see potential inconsistencies, and enables to reconcile the dates of episodes of for instance contraceptive use with the dates of other events recorded in the calendar. The DHS for Bangladesh was different from other DHS because the calendar was transformed into a local one. The researchers did not refer to Gregorian months, but to local Bangladeshi months. An experiment in the DHS in Peru, in which two approaches were used to collect data on contraceptive use, found that reported durations of contraceptive use, collected with the help of an experimental calendar, were not heaped, compared to reported durations collected without the calendar (Goldman, Moreno and Westoff, 1989). Another experi-

ment, conducted in five countries, comparing DHS II (with the calendar) and DHS III (without the calendar), showed that the DHS calendar is successful is reducing heaping at reported durations of 6, 12, 18 and 24 months for breast-feeding and amenorrhoea (Becker and Diop-Sidibé, 2003).

Historical calendars may help to date events (e.g. Ewbank, 1981; Freedman et al., 1988; Hertrich, 1993). The historical calendar consists of a chronological list of events, which are important for the region under study. People are asked to place the events in relation to local events. The calendar involves a linkage of 'recollected *public* events with *personal* activities or events, which occur within a known and restricted age range' (Scott and Sabagh, 1970: 94). The earliest use of the method of relating births to notable events was by anthropologists in Australia, reported in 1865 by Oldenfield (Scott and Sabagh, 1970). Sometimes the use of these calendars is questioned because it would be too long and tiring for the respondents (Scott and Sabagh, 1970; Ewbank, 1981). According to Hertrich (1993) a disadvantage of the historical calendar is that regional events may have no impact at the village level because these are not real 'landmarks' for the local population. Ewbank (1981) argues that several major problems exist with the use of historical calendars. The first problem that arises is making a list that is applicable to all the respondents included in a survey. Not everybody remembers events that interviewers consider as important events, for example Muslim events that are not important to Hindus or the birthday of an important person that is not of significance to respondents. In regions where large parts of the population are illiterate and have no access to radios or television, people are even more likely to be unaware of 'important' events. The second problem is that even when respondents remember the significant events, they probably cannot relate them chronologically to their personal events. Producing historical calendars is time-consuming and expensive, according to Ewbank (1981). Scott and Sabagh (1970) state that a calendar should contain events covering 'every year for the past century or so' (p. 94). In large-scale surveys the difficulties associated with the production of (many different) local calendars, and the training and supervision of interviewers, may reduce the impact of the historical calendar with the consequence that the calendars will not be cost effective (Ewbank, 1981). Ewbank even states that 'efforts to improve age reporting in surveys through the use of local calendars of historical events are probably a waste of time and money' (p. 84).

From this we may conclude that heaping is a serious problem in data analysis. Our argument is that to prevent heaping, it is necessary to use a local time-path calendar in understanding the time perspective of respondents. This local calendar is developed on the basis of theory on time dimensions and the local context. Different time dimensions and perspectives are described in the next section.

Dimensions of Time

In the field of demography, De Bruijn (1999) and Mills (2000a, b) have written extensively about the time aspect in demographic research. One of the distinctions often made is that between static and dynamic time. Static time implies that history does not matter, and the past and future play the same role. A dynamic view emphasizes that an event is the outcome of a process developed in time.

According to Jacques (1990/1982), time can be divided in chronological time, measurable by clocks, called 'Chronos', and, in the human and living time of intentions and goals, called 'Kairos'. De Bruijn (1999) and Mills (2000b) both distinguish different dimensions of time. De Bruijn argues that historical, institutional, social, individual, and process time may be seen as clocks that run simultaneously, although on different scales. Social time is a time perspective whereby people's lives consist of different stages represented by distinct rules for relations with other people, responsibilities, duties, and behaviour (Becker, 1989; De Bruijn, 1999). A generally agreed standard exists to which people ascribe their behaviour. This standard creates expectations about events that ought to occur at a certain age, or durations that ought to have a particular length. Examples are the age at which a girl ought to have her first menstruation and the duration between marriage and first birth. An important marker in the social time dimension is a rite of passage. To illustrate this, we use an example from an earlier study in the research area (Hutter, Rajeswari, Hallad and Ramesh,1999). In this study it was found that menarche is the physical start of the reproductive career and is often celebrated as a rite of passage with a special ceremony. Maturity indicates a major change in the life course. Sometimes changes take place after the event of menarche, for example a shift in dressing to ankle length skirts, refraining from playing physical games and encouragement by elders to stay at home. Within the reproductive career, several songs are sung to accompany important events, for example the *soobhana* which is sung during marriage and first pregnancy, but is also sung at the time when a girl has her first menstruation. Marriage is the marker for the socially accepted start of the reproductive career and is subject to strict rules and prohibitions. Traditionally a girl is supposed to marry as soon as she reaches puberty, or even before. After the consummation of marriage, an Indian woman will gain status when she proves her fertility. Therefore the duration between marriage and first birth is usually very short, and practically no contraceptives are used within this period (Hutter, 1998; Hutter, Rajeswari, Hallad and Ramesh, 1999).

Mills (2000b but see also Hägerstrand, 1988) has made a division between different aspects of temporality. She distinguishes natural and cosmic time, biological and psychological human development, historical time, cultural and social time, and institutional calendars. The relatively fixed, repetitive or cycli-

cal rhythm of the natural environment such as lunar and seasonal cycles makes up natural or cosmic time. In India, some festivals entail specific behaviour like refraining from sexual relationships. Examples of this are full and new moon days and sun or moon eclipses. Astrology may play an important role in everyday life in society. People in the research area in South India conduct agricultural activities, marriages, journeys and other important events only after they have consulted the *Panchanga* that advises about the most favourable day and time (Hutter, 1994). The *Panchanga* is an astrological yearbook, providing information about which period and which time is most suitable and auspicious for sowing or harvesting but is also used for many other activities, including sexual relationships. Certain periods are more or less suitable for conception, which may be reflected in fertility patterns. According to Mills (2000b), cultural time is the subjective conception, use and meaning ascribed to temporality manufactured within different cultures. Like De Bruijn (1999), Mills (2000b) defines social time as norms, values, rules and responsibilities about the expected time that a life event ought to occur (p. 102). In the case of partnership and fertility behaviour, social time manifests itself through calendars that prescribe the ideal age at marriage, at having a first child, at ending one's fertility career and ideal duration intervals (for instance, between two births). Institutional time, viewed through institutional calendars, is defined as the timetables produced via the adaptation and life span of institutions (p. 103). These institutions are often accompanied by calendars that regulate everyday life and thus most behaviour in the life course. Calendars dictate most individual action and group interaction in everyday life. Zerubavel (1977) stresses that calendars are strictly a social convention, strengthening Sorokin's (1964) statement that the idea of time and its divisions is to a great degree a social convention. A calendar may be seen as an expression of a time perspective, which means we can understand time perspectives by studying the different calendars that people use in their daily lives.

Calendars

Many calendars co-exist, like the Julian calendar, the Chinese lunar zodiac calendar, the Hindu calendar, or for instance the work calendar. The origin of a calendar is an interweaving of natural, cosmic and agricultural cycles with socially constructed aspects of religious cosmologies (Mills 2000b: 104). Calendars determine auspicious and inauspicious dates or years for life events such as marriage or childbirth. For example the Chinese New Year caused a peak in marriages in Malaysia, Singapore, Hong Kong and Taiwan according to Abeysinghe (1991).

In many primitive cultures, social activities form the principal markers for

time reckoning (Sorokin and Merton, 1943/1990). Evans-Pritchard (1940) illustrates this by showing that perception of time of the Nuer (a pastoral people living along the upper Nile) is reflected by the ecological setting in which they live and by the interrelationships within the social system. The Nuer developed a time-reckoning system based on cyclic ecological changes. Evans-Pritchard distinguishes two concepts of time: Ecological time, based on the relations of the Nuer to the environment, and structural time, based on reflections on their relations to each other in the social structure. The Nuer do not use the name of months to indicate the timing of events, but refer to specific activities, because to them time is a relation between activities. For example, 'in the month of *dwat* one breaks camp and returns to the villages, and since people are on the move it must be *dwat* or thereabouts' (p. 100). To indicate the duration of time, primitive people frequently use their daily business to indicate time, for instance 'the man died in less than the time in which maize is not yet completely roasted', i.e. less than about 15 minutes (Sorokin, 1964). Malinowski (1926–7/1990) studied calendar arrangements among the Trobriand Islanders of northwest Melanesia. He found that the Trobrianders make use of astronomical, meteorological and cultural time. Astronomical time is based upon observation of the sun, the moon and the stars; meteorological time is derived from repeated changes in wind and weather; and cultural time is based on human seasonal activities. With the information gathered, the Trobrianders plan expeditions, festivities, commemoration rites and count several generations back, and place events in certain periods in the future.

The Gregorian or Christian calendar is almost generally accepted throughout the world since its inception 400 years ago. This calendar is 'international, inter-religious, inter-occupational and interracial' according to Wilson (cf. Zerubavel, 1981: 100). The number of other calendars is very small, according to Goudsblom (1997). The combination of the Christian era and the Gregorian calendar is in most of the world indisputably decisive; but days, months and years can differ. The Christian ecclesiastical calendar is an example of an arithmetic lunar-solar calendar, which attempts to keep in synchrony with the moon and the sun, whereas the Indian calendar is an astronomical lunar-solar calendar. In such a calendar the start of the month or year is determined by astronomical calculation (Richards, 1998).

The animal calendar influences life events. In Vietnam, more births and marriages have been reported in years that are considered to be auspicious according to the astrological calendar in use. Thang and Swenson (1996) argue that purposeful planning of births and marriages coincides with optimal times defined in the astrological calendars. In Taiwan, 1976 was the year of the dragon and dragon years are regarded as most favourable for births. The crude birth rate in 1976 showed a remarkable increase compared to the preceding years. A reverse phenomenon was found in Japan in 1966. In Japan, 1966 was

the 'Year of the Fiery Horse', which only occurs once every 60 years. It is said that girls born in these years will murder their husbands, greatly reducing their prospects of marriage. As a result, the birth rate fell dramatically. The above suggests that the traditional values inherent in the animal calendar are capable of influencing the timing of births, as well as offering a mechanism for recalling one's date of birth (Jowett, 1992).

The time perspective of the study population of the present research is mainly determined by the Hindu calendar, in combination with local and national festivals. For that reason, we now briefly discuss some contextual information concerning this calendar.

Indian calendar makers construct an almanac each year; the one mentioned earlier, *Panchanga*, which provides information concerning the position of the moon relative to the sun (Richards, 1998). The *Panchanga* consists of five elements of time division. The most important concepts for this article are *amavasye* and *hunnime*, which are associated with one of the elements. *Amavasye* is the moment of new moon, or that point of time when the longitudes of the sun and moon are equal. *Hunnime* is the moment of full moon, or that point when the moon is furthest from the sun (Sewell and Dîkshit, 1896: 3). A *tithi* is approximately the length of a solar day, varying from 21 to 27 hours. The Sanskrit names of these *tithis* can be found in the names of Hindu festivals, for example Ganesh Chaturthî (fourth day) or Nagar Pañchamî (fifth day). Hindu people keep count of the days before and after a full and new moon because festivals occur on specific days, for example five days after a full moon. The Hindu lunar-solar calendar contains 12 months, marked by the phases of the moon, with an occasional 13th month to reconcile it to the seasons. The month in which the *Mêsha Sankrânti,* or entrance of the sun into the sign of the zodiac *Mêsha*, or Aries, takes place, occurs each year and is called *Chaitra* (Sewell and Dîkshit, 1896). In the western calendar, this corresponds to March or April and is the start of the Hindu year.[2] In South India, every month starts the day after a new moon day (*amavasye*). The Hindu New Year starts the day after Ugadi Amavasye. The names of the lunar months are derived from *nakshatras.* A *nakshatra* is the time that the moon (or any other heavenly body) requires to travel over the 27th part of the ecliptic (Sewell and Dîkshit, 1896: 3). More easily put, the moon encounters several stars on its way around the earth and nearly travels one *nakshatra* daily, making a total of between 27 and 28 days (Richards, 1998).

The elements of time division together with the full and new moon days are related to the life of Indian people because almost all festivals depend on this astronomical lunar-solar calendar. Some religious ceremonies have to be performed in certain months, at certain *tithis* and at fixed times of the day. For example, the worship of the god *Ganesh* has to take place on *Bhadrapada shukla chaturthî* during the third part of the five parts of the day. This means it

should take place in the month starting after Benakan Amavasye (*Bhadrapada*), in the bright half of the month (*shukla*, the first fortnight of the month), on the fourth day (*chaturthî*, which is the fourth *tithi*) and on the third of the five parts of the day.

From this section we may conclude that the Hindu calendar and its accompanying events is an important determinant of time reckoning in the research area in South India. We now hypothesize that a local time-path calendar, in this case based on festivals and full and new moon days, allows people to think in their own time frame. This time frame has a direct impact on daily life of people. We expect that by using a local time-path calendar, duration heaping can be reduced.

Data

The purpose of the project is to test the hypothesis whether using a local, time-path calendar based on time conceptions of the local population can prevent heaping in duration data. A small-scale survey was conducted in February 2000 in the Dharwad district, Karnataka, India, among 61 women, including 65 completed birth intervals.

The research area includes primarily small villages, with a high level of illiteracy among its population. Important sources of income are either cultivation of own land or labour work on daily wages. Ninety percent of the population in the research area are Hindu. Most households are nuclear households. Further demographic indicators include a crude birth rate of 27.6 and a crude death rate of 10.5 per 1000 of the population, and an average age at marriage of 23.4 years for males and 16.3 years for females (Rajeswari and Hutter, 1998).

We expect that higher educated women report less heaped durations than lower educated women, based on the idea that the former group has more access to and a better understanding of time devices and calendars than the latter group. Because of this better understanding, we expect them to be more precise in reporting. The present survey was set up in a way that two distinct groups of respondents could be distinguished. The distinction is based on the extent of modernization, in this research operationalized through place of residence and level of education. The more educated women, in comparison with the lower educated women, besides having a higher educational level, marry at later ages, and more often own a television or radio, and in rare cases, own a telephone. They live closer to the regional centre (three villages close to Dharwad were selected), therefore we assume that they are more exposed to urban influences than the lower educated women. Furthermore, these women live in relatively larger villages, have easier access to transport facilities, more often have a toilet facility (although it is still rarely found), and more frequently have a private tap

or hand pump as a source of drinking water. Moreover, their source of income is more often outside of agriculture. The lower educated women were selected from more isolated villages, located relatively far from Dharwad.

In the villages, the respondents were selected on the basis of several criteria. Women needed to have had at least two live births in the last five years; in the Indian context this implies that they are married. In the first place, respondents were selected from the former census and survey that had taken place in the research area. Married women with at least one small child, and women who were pregnant at time of the 1997 survey, were selected. In the villages the prepared lists were discussed in the local nursery school (*anganwadi*), where records of pregnant women are kept. On the basis of the knowledge and networks of the teachers in the school, eligible women were selected. Furthermore, respondents were found during the fieldwork in the villages through respondents and neighbours.

The questionnaire contained questions related to the socio-cultural and socio-economic situation of respondents (religion, caste, family type, literacy, income, electricity, toilet facilities and access to communication media). Some demographic data (age, age at menarche, age at marriage), and information about children and pregnancies (number of pregnancies, confirmation date of pregnancy, duration of pregnancy) were collected. The key section of the questionnaire was concerned with the duration of the proximate determinants of birth intervals. After asking for the duration as remembered by the respondents, the duration was also estimated by using the local time-path calendar. This calendar was developed on the basis of local expertise, and contains dates and information on Hindu, Muslim and Christian festivals, national holidays, and new and full moon days in the last five years. Besides Hindu dates, the local time-path calendar also includes Gregorian months and days, like Sunday, Monday and so on. With the calendar, the memory of respondents is triggered, enabling them to think in their own time scheme, aiming to reduce bias. Given the objective of the research, and restrictions concerning recall bias, it was decided to select only those respondents who had at least two live births in the last five years. The final section of the questionnaire dealt with some questions concerning perception of time, related to knowledge of calendars, dates, and the possession of time devices.

The survey yielded 54 eligible cases (women) with 57 completed birth intervals for analysis. From the 61 women originally included, six could not be selected for either of the distinguished groups because they did not meet the criteria (for instance they were illiterate and were living in one of the villages close to Dharwad). Furthermore, the data for one woman was not included because she turned out to have had only one live birth.

Research Method

The aim of the survey is to find out whether a local time-path calendar can prevent heaping in duration data. Therefore, two types of durations were distinguished, to be able to compare both. *Reported duration* results from the answer to the question about the length of the durations of postpartum amenorrhoea, breastfeeding, postpartum abstinence, and contraceptive use. The *estimated duration* arises out of the measurement of these durations with the local time-path calendar.

The following is a description of how the interviewers use the calendar. For every month, the interviewer probes if the respondent, after a live birth, was menstruating again, started or stopped breastfeeding, started sexual relationships or started or stopped using contraceptives. The interviewer goes back in time with the respondent. From the first live birth from the five-year period onwards, the respondent is invited to relate personal events to events in the calendar, by mentioning all events occurring from a personal event (for instance a live birth) onwards. So for December 1997, the interviewer mentions some festivals during this month (for instance Hotsal Hunnime, see Table 1). This is repeated for every month until the respondent remembers the start or end of the duration asked and relates it to a certain festival or other special day in the calendar. All events are related to the festivals in the calendar.

The calendar method is explained by using an example. Table 1 shows a part of the local time-path calendar, namely the Gregorian months December 1997 and January 1998. We take the example of a woman that had a live birth on 24 April 1997, which in this case was stated on the basis of a birth certificate. In most cases, however, the birth date was fixed with the help of the calendar, since most women had no birth certificate and could not remember the Gregorian date of birth. In the column 'pregnancy outcome', 'live birth' is written down on 24 April. For every month, the interviewer asks if the respondent's menstruation has returned. In this example the interviewer mentions some festivals that took place during September 1997, for example Ganesh Chaturthî. The respondent answers that during Ganesh Chaturthî she did not have her period yet. The interviewer marks the month September 1997. This goes on for every month until the respondent connects a festival or other special day to the period she was not amenorrhoeaic anymore. For example the interviewer asks: 'Were you still amenorrhoeaic on Hotsal Hunnime?' The respondent answers affirmatively, but says that ten days after Hotsal Hunnime her menstruation resumed. During the process of asking questions and interaction with the respondent, the interviewer marks those months in which the menstruation has not returned. Finally, it is noted that on 24 December, ten days after Hotsal Hunnime, this woman's menstruation resumed, which is shown in Table 1. The same procedure is followed for the case of breastfeeding, abstinence and contraceptive use. In this example,

TABLE 1
An example of the use of the local time-path calendar

Year	Month	Date	Festivals/Hunnime/Amavasya	Hindu Month	Day	Amenorrhoea	Breastfeeding
1998	January	30	Id Ul Phitar (Ramazan Id)	Phalguna	Fri		
	January	28	Avaratri Amavasye	Magha	Wed		
	January	27	Shabbe Kadar/Jamatul Vida	Magha	Tue		
	January	26	Republic Day	Magha	Mon		25: bf stopped
	January	21	Shahadat Hazarat Ali	Magha	Wed		
	January	14	Makar Sankranti	Magha	Wed		
	January	12	Banad Hunnime	Magha	Mon		
	January	1	Ramazan beginning day	Magha	Thu		
1997	December	29	Yallu Amavasye	Pushya	Mon		V
	December	25	Christmas Day	Pushya	Thu	24: period started	
	December	16	Shabbe Barat	Pushya	Tue		
	December	14	Hotsal Hunnime	Pushya	Sun		

we can see that this respondent stopped breastfeeding on 25 January. This respondent indicated that the Sunday before Avaratri Amavasye she stopped breastfeeding her child. Every month in which she had been breastfeeding, is marked (the 'v' in December), and the date of 25 January has been noted down. The months in the abstinence column are empty, since this respondent resumed sexual relations some months before December 1997. This respondent did not use any contraceptives, so these months have also been left empty. The sequence in which the interviewers handle the calendar is that first they ask about the period of postpartum amenorrhoea. Next, the period of conception, the confirmation date (by a doctor) of the pregnancy, and the following pregnancy outcome are discussed. Breastfeeding, abstinence and contraceptive use are dealt with at the same time, so that respondents only have to go through the calendar twice.

After the completion of the questionnaire and the processing of data, two types of duration appear. The first is the *reported duration* mentioned earlier; for example, the above respondent had reported that she had been amenorrhoeaic for nine months. However, when counting the months in the local time-path calendar in this case, we count eight months: The live birth was on 24 April 1997 and the menstruation started again on 28 December 1997. This is now called the *estimated duration*. In this example the difference between the two durations is one month. In the same way the reported and estimated durations of breastfeeding, postpartum abstinence and contraceptive use are calculated.

Findings

Duration of postpartum amenorrhoea

Postpartum amenorrhoea is an important determinant of the length of birth intervals (Bongaarts, 1982). In developing countries, and especially in India, women may be amenorrhoeaic for long periods. In the research area, a mean of nine months of postpartum amenorrhoea was found in 1997 (Hutter, Rajeswari, Hallad and Ramesh, 1999). For the current survey, the mean reported duration of postpartum amenorrhoea was found to be 10 months, whereas the mean estimated duration of this variable is 9.7 months (measured for 57 complete birth intervals). The mean reported and estimated duration of postpartum amenorrhoea do not differ much. The distribution of the reported durations is displayed in Figure 1. Heaping is evident on 1, 12 and 18 months (and to a lesser extent on 24 and 30 months). In the same figure, the estimated durations of postpartum amenorrhoea are shown. Heaping is less present on 12 and 18 months. Instead, the figure shows a smoother distribution of durations. Seventeen percent of the respondents had reported to be amenorrhoeaic for 12 months, but this percent-

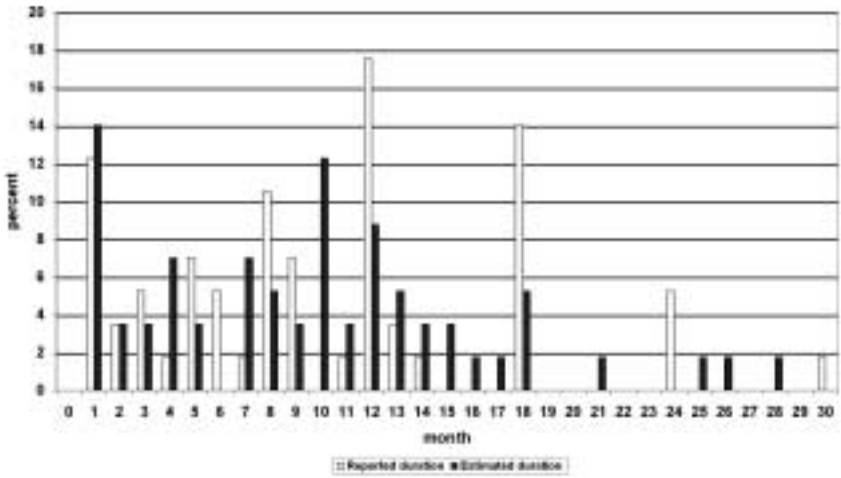

FIGURE 1
Percentage distribution of reported and estimated duration of postpartum amenorrhoea in months, all respondents

age was estimated to be only eight per cent. Eight respondents reported to have had no menstruation for 18 months; only three women were estimated to have such a period of amenorrhoea.

The most common shape for the distribution of postpartum amenorrhoea is bimodal (Ford and Kim, 1987). In Figure 1 we indeed may observe a bimodal distribution of the estimated values of postpartum amenorrhoea, with peaks at one and 10 months. We may conclude that in this survey duration heaping in postpartum amenorrhoea can be reduced by using a local time-path calendar instead of asking direct questions about the length of this duration.

When comparing the two groups of respondents, namely the educated, more urbanized respondents and the lower educated, more geographically isolated respondents, we find more heaping in the reported durations for the latter group.

Duration of breastfeeding

Literature shows that there is a relationship between breastfeeding and postpartum amenorrhoea: Breastfeeding prolongs the duration of postpartum amenorrhoea (Perez et al., 1972; Jain and Bongaarts, 1981). Therefore breastfeeding is an important determinant of the length of birth intervals (Bongaarts,

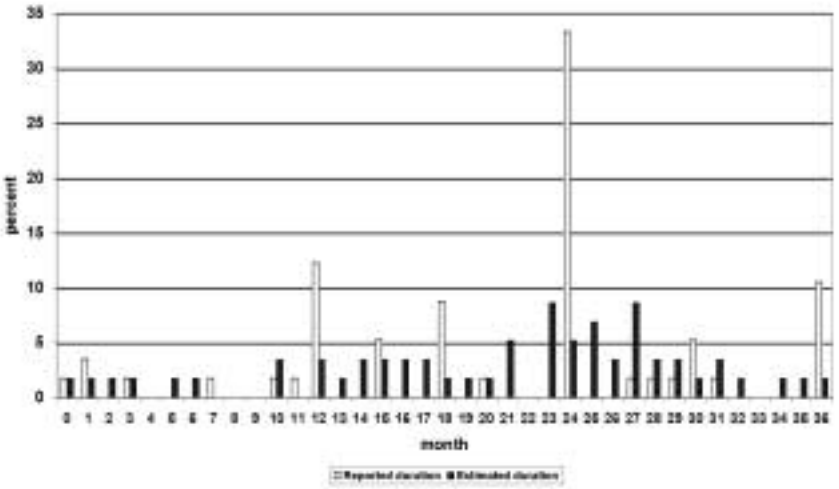

FIGURE 2
Percentage distribution of reported and estimated duration of breastfeeding in months, all respondents

1982). Fifty-five reported and estimated durations of breastfeeding were measured in the current research. Two respondents were excluded from analysis since they reported that their children died soon after delivery; therefore the children were not breastfed. The mean reported duration of breastfeeding was found to be 20.9 months; the average estimated duration of breastfeeding is 20.6. The mean reported and estimated durations of breastfeeding thus are very close. Figure 2 shows the percentage distribution of the reported and estimated duration of breastfeeding. Heaping is evident on 12 and 24 months. No less than 33 percent of the respondents reported to have breastfed their child for two years. Heaping is also present at 18, 30 and 36 months. When we compare this picture with the estimated duration of breastfeeding, we find a vast difference between the two durations. The estimated figure shows a smoothed picture, with no heaping on months that are multiples of three. We can conclude that the local time-path calendar is efficient in reducing duration heaping.

There is no clear difference in reporting the duration of breastfeeding for the two groups of respondents: For both groups we find severe heaping in the reported durations, as well as practically no heaping in the estimated figures.

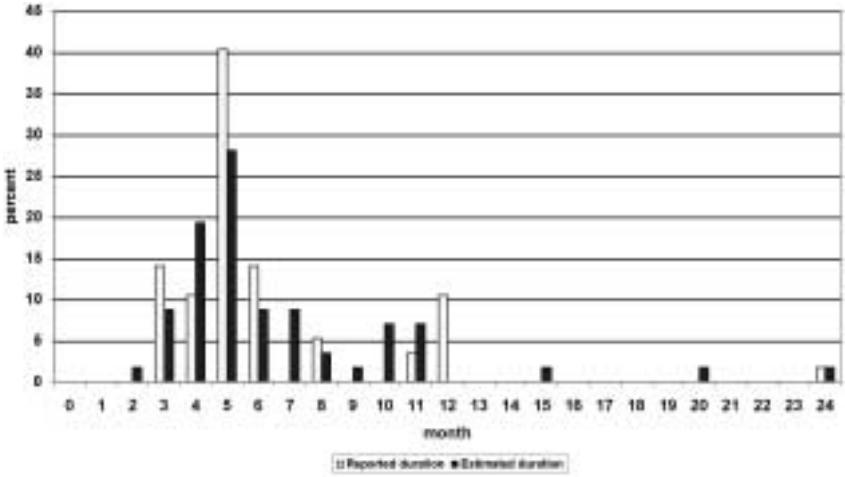

FIGURE 3
Percentage distribution of reported and estimated duration of postpartum abstinence in months, all respondents

Duration of postpartum abstinence

The longer women abstain from sexual relationships, the longer they cannot get pregnant and the longer the interval between two consecutive births. In the current research, a mean reported duration of 6.2 months of postpartum abstinence was found among 57 birth intervals. The average estimated duration of abstinence was found to be 6.6 months. Again the means are close. Figure 3 shows the distributions of the reported and estimated durations of abstinence in the current research. We can conclude that the duration most reported by the respondents is five months. Some heaping is visible at 12 months. The estimated figure shows that five months is still popular but a little less than the reported figure. We may argue on the basis of these findings that postpartum abstinence for five months is a common social practice in the research area, resulting in a heaping of observations at five months. Heaping at 12 months has completely disappeared in the estimated figure. The corresponding estimated durations belonging to the reported durations of 12 months are 8, 10, 11 (twice), 15 and 20 months.

There are substantive differences between reported durations of postpartum abstinence for the two distinguished groups of respondents. The data for the educated, more urbanized respondents show much lower durations than

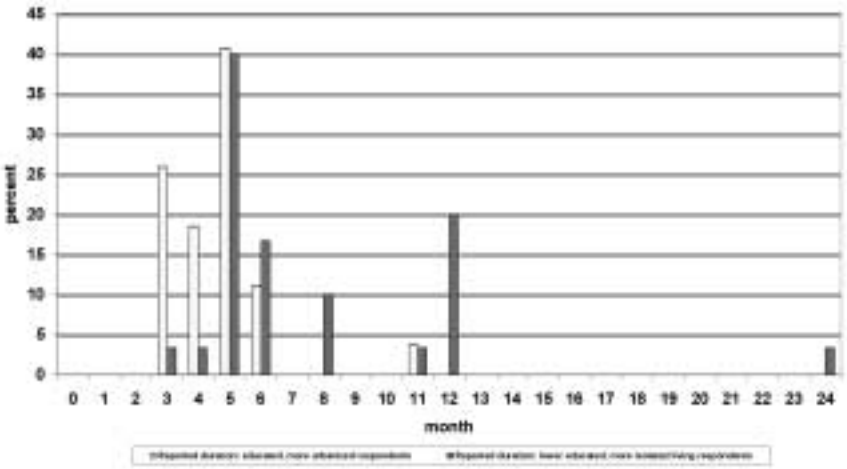

FIGURE 4
Percentage distribution of reported duration of postpartum abstinence in months, educated, more urbanized respondents (*N* = 27), and lower educated, more geographically isolated respondents (*N* = 30)

the other group (an average of 4.6 in contrast to an average of 7.6 months). The difference reflects high, heaped values of durations, reported by the group of the lower educated, isolated living respondents. The two distributions of durations differ much, although heaping on five months occurs for both groups (Figure 4). We may conclude that using a local time-path calendar, instead of only collecting reported durations of postpartum abstinence, can reduce duration heaping for postpartum abstinence. However, it has to be mentioned that the calendar may have a smoothing effect as well, where it is not desirable: The concentration on five months could be genuine, based on common practice.

Duration of contraceptive use

Contraceptives can prolong birth intervals considerably. However, in the research area not many modern spacing methods are used. Among the 55 women in the study, only three women (who belonged to the group of educated respondents) had used a modern contraceptive method: One woman had used Copper T (a type of IUD) and two women had used oral pills, all three for very short periods. On the basis of three respondents we cannot draw any conclusions.

Conclusion and Discussion

In this article we discussed heaping in connection to theoretical aspects of time. We argued that it is necessary to understand the time frame of respondents, if we want to understand and reduce the extent of heaping in data. Here the time frame is based on festivals and full moon days. The local time-path calendar, based on the time perspective of respondents, was discussed. In comparison to the DHS calendar, the local time-path calendar is different in three ways:

1. Unlike the DHS calendar, which is a monthly calendar, the local time-path calendar is based on Hindu months, local festivals and new and full moon days. Events may be recorded on each day of the year, in contrast to the DHS calendar in which events are recorded per month. The use of months as temporal units assumes that only one event may occur during the month. Khatun and Willekens (2001) also stress this limitation;
2. The knowledge of the timing of full and new moon days is very good among the majority of respondents. Therefore in this specific survey and local setting, the local time-path calendar is an efficient method to prevent heaping in duration data;
3. A strength of the new method is that respondents are taken through time in a prospective way. From a live birth onwards, respondents are taken through time from festival to full or new moon day, until a specific event is related to a point in time familiar to them.

We can conclude that duration heaping can be reduced by using a local time-path calendar in estimating the durations of the proximate determinants of birth intervals. This conclusion is valid for the duration of postpartum amenorrhoea, breastfeeding, and postpartum abstinence. For these variables heaping disappeared. For the current research, the local time-path calendar has been efficient in reducing heaping. The efficiency was strongly enabled by the fact that respondents in the research area keep very precise track of time, via a system of festivals and full and new moon days. The respondents seem extremely capable of remembering events when their memory is triggered and the interviewer takes the respondents back in time.

Duration of breastfeeding is very prone to heaping, partly caused by the length of this duration, which is generally very long: The longer the duration, the more heaping is observed. Both lower educated, more geographically isolated respondents and higher educated, more urbanized respondents are very prone to show heaping in the duration of breastfeeding, with a mode of 24 months. Especially for the duration of breastfeeding the calendar method yielded interesting results: The enormous heaping that appeared in the reported durations had virtually disappeared when using the calendar method.

We can conclude that there is a difference in reporting among women from

different educational backgrounds. In this research, lower educated respondents living in more isolated villages were more inclined to report durations on multiples of three months than higher educated respondents who live in villages closer to the regional town. The difference is clear for the duration of postpartum amenorrhoea and abstinence, but less for the duration of breastfeeding. The estimation of the durations by means of the local time-path calendar did not yield a real improvement in the distribution pattern of the duration of postpartum amenorrhoea and abstinence for the higher educated and urbanized respondents, since this group showed less heaping for these variables.

When using the local time-path calendar in estimating the means of the durations of proximate determinants of birth intervals, often the mean reported duration corresponds to the mean estimated duration. This means the calendar is redundant if the aim is just to produce means of distributions. However, when the aim is to analyse distributions, the calendar has proven to be a useful tool in preventing heaping in duration data.

The calendar method may cause undesirable smoothing of a distribution. This is, for example, the case for postpartum abstinence: Heaping occurs at five months. This heaping could be a representation of the truth, a common practice to observe five months of postpartum abstinence after delivery. The estimation showed the same concentration on five months, for both groups of respondents. This phenomenon of local concentrations was also observed by Lesthaeghe and Page (1980), who explained it as a genuine concentration caused by actual behaviour, governed by strong norms. Similarly, Jain and Bongaarts (1981: 80–1) observed that there might be 'cultural preferences or norms' at stake to breastfeed children for either 12 or 24 months. In this article strong concentrations on 12 and 24 months of breastfeeding were also found. However, in the estimated figure, heaping had disappeared. This indicates a bias in reported durations that is reduced when measured with the local time-path calendar.

For the duration of contraceptive use no statements can be made due to the small number of users. Furthermore, the calendar method is not useful for the estimation of the duration of pregnancy; for the respondents it was too difficult to remember the conception date or the confirmation date of the pregnancy.

We have to note that the sequence of questions may have had an impact on the quality of data. The fact that we first asked the duration (*reported* duration), and after that used the calendar to determine the same duration (*estimated* duration) may have influenced the results.

Using the calendar method in interviews takes time; in the current research interviews lasted about 45 minutes; using the calendar alone lasted approximately 20 minutes. In large surveys the method could be too time-consuming.

Based on the success of the method in the Indian context, we recommend the use of several local time-path calendars, based on local calendars and events, to be used in large-scale surveys such as the Demographic and Health Surveys.

Notes

An earlier version of this article was presented at the Annual Meeting of the Population Association of America, 1–3 May 2003, Minneapolis. We would like to thank the two interviewers, Mrs A. Joshi and Ms S. K. Sankangoudar of the Population Research Centre, J. S. S. Institute of Economic Research, Dharwad, India for useful comments on the questionnaires and for making the project a success. We thank Mr G.C. Jadar from PRC Dharwad for documenting the festivals and full and new moon days in the research area. Furthermore, we would like to thank all the respondents from the villages who participated in the project.

1. Personal communication by email with Sian Curtis, Senior Evaluation Analyst, ORC Macro (Macro International Inc.), 2000.
2. In Northern India the year sometimes starts in autumn, in the month Karthika.

References

Abeysinghe, T. (1991) 'A Seasonal Analysis of Chinese Births', *Journal of Applied Statistics* 18(2): 275–86.

Becker, H. A. (1989) 'Theoretisch Kader voor de Analyse van Levenslopen en Generaties', in H. A. Becker and P. L. J. Hermkens (eds) *Oude Naast Nieuwe Generaties. Maatschappelijke positie en Waardenoriëntaties van Ouderen Vergeleken met die van Jongeren*, pp. 63–98. University of Utrecht: ISOR.

Becker, S. and Diop-Sidibé, N. (2003) 'Does Use of the Calendar in Surveys Reduce Heaping?', *Studies in Family Planning* 34(2): 127–32.

Boerma, J. T. (1996) *Child Survival in Developing Countries. Can Demographic and Health Surveys Help to Understand the Determinants?*. Amsterdam: Royal Tropical Institute.

Bongaarts, J. (1982) 'The Fertility-inhibiting Effects of the Intermediate Fertility Variables', *Studies in Family Planning* 13(6/7): 179–89.

De Bruijn, B. J. (1999) *Foundations of Demographic Theory. Choice, Process, Context*. Amsterdam: Thesis Publishers.

Evans-Pritchard, E. E. (1940) *The Nuer. A Description of the Modes of Livelihood and Political Institutions of a Nilotic People*. Oxford: Clarendon Press.

Ewbank, D. C. (1981) *Age Misreporting and Age-selective Underenumeration: Sources, Patterns, and Consequences for Demographic Analysis*. Washington, DC: National Academy Press.

Ford, K. and Kim, Y. (1987) 'Distributions of Postpartum Amenorrhoea: Some New Evidence', *Demography* 24(3): 413–30.

Freedman, D., Thornton, A., Camburn, D., Alwin, D. and Young-DeMarco, L. (1988) 'The Life History Calendar: A Technique for Collecting Retrospective Data', *Sociological Methodology* 18(1): 37–68.

Goldman, N., Moreno, L. and Westoff, C. F. (1989) 'Collection of Survey Data on Contraception: An Evaluation of an Experiment in Peru', *Studies in Family Planning* 20(3): 147–57.

Goudsblom, J. (1997) *Het Regime van de Tijd*. Amsterdam: Meulenhoff.

Haandrikman, K. (2001) *Coping with Time. Measurement and Perceptions of Age and Durations in Reproductive Health Surveys*. Population Research Centre Master Thesis Series 01–2. Groningen: University of Groningen.

Hägerstrand, T. (1988) 'Time and Culture', in G. Kirsch, P. Nijkamp and K. Zimmerman (eds) *The Formulation of Time Preferences in a Multidisciplinary Perspective*, pp. 33–42. Avebury: Gower Press.

Hertrich, V. (1993) 'The Contribution of Existing Sources to the Dating of Events. A Survey in Mali's Bwa Country', *Population: An English Selection* 5: 73–99.

Hutter, I. (1994) *Being Pregnant in rural South India. Nutrition of Women and Well-being of Children*. Amsterdam: Thesis Publishers.

Hutter, I. (1998) *Reproductive Health and Child Spacing in Rural South India; Contribution to a Reorientation of Population Policies in India. Background Paper to the Project*. Groningen Demographic Reports 23. Groningen: University of Groningen.

Hutter, I., Rajeswari, N. V., Hallad, J. S. and Ramesh, B. M. (1999) *Reproductive Health and Child Spacing in Rural South India. Survey Basic Report*. Groningen Demographic Reports 26. Groningen: University of Groningen.

Jacques, E. (1990/1982) 'The Enigma of Time', in J. Hassard (ed.) *The Sociology of Time*, pp. 21–34. London: Macmillan.

Jain, A. K. and Bongaarts, J. (1981) 'Breastfeeding: Patterns, Correlates, and Fertility Effects', *Studies in Family Planning* 12(3): 79–99.

Jowett, A. J. (1992) 'Age-heaping: Contrasting Patterns from China', *GeoJournal* 28(1): 427–42.

Khatun, M. and Willekens, F. J. (2001) *The Life History Calendar. Technical Aspects of Data Analysis Using Contraceptive Calendar of the Bangladesh Demographic and Health Survey*. Population Research Centre Working Paper 01–2. Groningen: University of Groningen.

Lesthaeghe, R. J. and Page, H. J. (1980) 'The Post-partum Non-susceptible Period: Development and Application of Model Schedules', *Population Studies* 34(1): 143–69.

Malinowski, B. (1926–7/1990) 'Lunar and Seasonal Calendar in the Trobriands', in J. Hassard (ed.) *The Sociology of Time*, pp. 47–55. London: Macmillan.

Mills, M. (2000a) *The Transformation of Partnerships. Canada, the Netherlands, and the Russian Federation in the Age of Modernity*. Amsterdam: Thela Thesis.

Mills, M. (2000b) 'Providing Space for time. The Impact of Temporality for Life Course Research', *Time & Society* 9(1): 91–127.

Myers, R. J. (1993) 'Errors and Bias in the Reporting of Ages in Census Data', in D. J. Bogue, E. E. Arriaga, G. W. Rumsey and V. Prachuabmoh *Readings in Population Research Methodology*, pp. 23–9. Chicago: UNFPA.

Newell, C. (1988) *Methods and Models in Demography*. London: Belhaven Press.

Perez, A., Vela, P., Masnick, G. and Potter, R. G. (1972) 'First Ovulation after Childbirth: The Effect of Breastfeeding', *American Journal of Gynecology* 114: 1041–7.

Potter, R. G. and Kobrin, F. E. (1981) 'Distributions of Amenorrhoea and Anovulation', *Population Studies* 35(1): 85–99.

Rajeswari, N. V. and Hutter, I. (1998) *Reproductive Health and Child Spacing in Rural South India. Census Basic Report.* Groningen Demographic Reports 25. Groningen: University of Groningen.

Richards, E. G. (1998) *Mapping Time. The Calendar and its History*. Oxford: Oxford University Press.

Scott, C. and Sabagh, G. (1970) 'The Historical Calendar as a Method of Estimating Age: The Experience of the Moroccan Multi-purpose Sample Survey of 1961–1963', *Population Studies* 24(1): 93–109.

Sewell, R. and Dîkshit, S. B. (1896) *The Indian Calendar. With Tables for the Conversion of Hindu and Muhammadan into A.D. Dates, and Vice Versa.* London: Swan Sonnenschein & Co.

Shryock, H. S. and Siegel, J. S. (1976) *The Methods and Materials of Demography.* New York: Academic Press.

Sorokin, P. A. (1964) *Sociocultural Causality, Space, Time*. New York: Russell & Russell.

Sorokin, P. A. and Merton, R. (1943/1990) 'Social-Time: A Methodological and Functional Analysis', in J. Hassard (ed.) *The Sociology of Time*, pp. 56–66. London: Macmillan.

Srinivasan, K. (1980) *Birth Interval Analysis in Fertility Surveys*. World Fertility Survey Scientific Reports No. 7: 19. Voorburg: International Statistical Institute.

Thang, N. M. and Swenson, I. (1996) 'Variations in Vietnamese Marriages, Births and Infant Deaths by Months of the Julian Calendar and Years of the Vietnamese and Chinese Astrological Calendars', *Journal of Biosocial Science* 28: 367–77.

Zerubavel, E. (1977) 'The French Republican Calendar: A Case Study in the Sociology of Time', *American Sociological Review* 42(6): 868–77.

Zerubavel, E. (1981) *Hidden Rhythms. Schedules and Calendars in Social Life.* Chicago: The University of Chicago Press.

KAREN HAANDRIKMAN is a lecturer at the Population Research Centre, Faculty of Spatial Sciences, University of Groningen, The Netherlands. ADDRESS: Faculty of Spatial Sciences, University of Groningen, PO Box 800, 9700 AV, Groningen, The Netherlands.
[email: k.haandrikman@frw.rug.nl]

N. V. RAJESWARI is Research Officer at the Population Research Centre, J. S. S. Institute of Economic Research, Dharwad, Karnataka, India. ADDRESS: J. S. S. Institute of Economic Research, Vidyagiri, Dharwad 580 004, Karnataka, India.
[email: ierdharwad@sify.com]

INGE HUTTER is Associate Professor at the Population Research Centre, Faculty of Spatial Sciences, University of Groningen, The Netherlands. ADDRESS: Faculty of Spatial Sciences, University of Groningen, PO Box 800, 9700 AV, Groningen, The Netherlands.
[email: i.hutter@frw.rug.nl]

B. M. RAMESH was at time of research Director of the Population Research Centre, J. S. S. Institute of Economic Research, Dharwad, Karnataka, India. ADDRESS: ICHAP, Pisces Building, #4/13-1 Crescent Road, High Grounds, Bangalore 560 001, Karnataka, India.
[email: bmramesh@ichapindia.org]