HISTCAL, a Program for Historical Chronology

P. Donche

1. Introduction

Chronology studies the ways in which time was measured or calculated. Historical chronology studies how this was done in the past to be able to convert dates expressed according to old dating methods into the method used nowadays. Chronology is therefore an auxiliary science to history.[1]

Conversion from old dating methods to the presently used method is not always simple. A short review of the difficulties that historians meet in performing this task will illustrate this.

The change from the Julian calendar to the Gregorian calendar introduced a new definition for leap years. A leap year in the Julian calendar is a year exactly divisible by four. With the calendar reform no centennial years are leap years, unless they are exactly divisible by 400. This new arrangement strongly increased the accuracy of the calendar. To compensate for the error accumulated during the use of the Julian calendar, a number of days needed to be skipped. At Rome, in Spain, Portugal, Italy and Poland, it was decreed that the day following 4 October 1582 was to become 15 October.

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However this calendar change was not introduced everywhere at the same time. The Protestant states in the Netherlands, Germany, Switzerland and Scandinavia hesitated for a long time before introducing the Gregorian calendar. England waited until 1752, the Slavonic and Baltic States waited until the beginning of the twentieth century, Russia until 1918 and Greece even until 1923. There are more than 40 different change dates known. So, for a long time, the Julian and Gregorian calendar coexisted in many, often adjacent geographical areas in Europe, with a 10 to 13 day difference in the dating of the same astronomical day.

Furthermore, the year number was not always changed on the 1st of January. In some countries and in some periods of time, 25 December (Christmas), 1 March (Venetian Style), 25 March (Lady Day, Stylus Annunciationes) and 1 September (Byzantine Style) were used as New Year's Day. Large parts of Europe even changed the year number with Easter, a moveable feast! In many countries and areas in Europe different styles have been in use. Therefore the year in a date, found on a document, sometimes needs to be increased by 1, to obtain the corresponding year according to the now universally accepted 1st of January Style (Stylus Circumcisionis).

Often dates were expressed as so many days or days of the week before or after a moveable religious feast, as e.g. 'the second Friday of the Lent 1280'. All moveable religious feasts relate to the date of Easter (that is, the first Sunday after the first full moon on or after the vernal equinox (21 March)) or Advent. The knowledge of the date of these key feasts is necessary to be able to correctly compute the month and day number of all other moveable feasts. The computation of the date of

Easter however, was also changed in the Gregorian calendar and thus introduces another discordance relative to the moveable feasts in different calendar areas. Moreover, between 1700 and 1776 the German Protestant states used yet another different computation scheme.

Originally, the leap day was not 29 February, but a numberless day between 23 and 24 February, called Bis Sexto Kalendas Martias in the Roman Republican calendar (which is the origin of the name bissextile year for a leap year).

In the Middle Ages the old Roman Republican method of numbering the days of a month was often used. In this system days were enumerated as so many days before a following key day (Kalendae, Nonae, Ides); for example, 29 September was named Tercio Kalendas Octobres.

Sometimes years are expressed relative to the starting year of the reign of a king or of the Pope.

Different cultures have produced their own calendar, mostly based on astronomical grounds. The Christian calendar is based on the periodicity of the seasons, the moving of the earth around the sun.

In contrast with the Christian calendar, the Muslim calendar is a moon calendar, based on the periodicity of the phases of the moon. Years only count 354 days, of which 19 in a cycle of 30 have a leap day. Because Muslim years are 11 days shorter than our years, New Year is celebrated every eight years in a different season, and the Muslim year number changes faster than ours.

The Jewish calendar is a lunisolar calendar of high perfection. The length of a month is computed to up to 1/1080 of an hour. In a cycle of 19 years, 6 different years lengths are used.

The French Republican Revolution also introduced a new calendar that however was shortlived.

2. HISTCAL

The study of historical chronology permits us to know the construction methods of the different types of calendars, and the methods used by medieval computists to compute the date of Easter. The three-volume work of F. K. Ginzel gives the most complete information on that subject.[2] Starting from this technical information, it was possible to write a program package that can perform date conversions and comparisons in an integrated manner, for every year between 1 AD and 2700 AD.

The underlying principle for conversion of dates between different calendars (Julian, Gregorian, French Republican, Jewish and Muslim) is the technique of reduction of a date to a universal day number.[3]

HISTCAL is a computer program written for the IBM-PC or IBM-PC compatible personal computer. It consists of three main modules: DATES, CALENDR and TABLES. They are used respectively for date conversions and chronological parameters of days, for a full year calendar (365/6 days) with chronological parameters for the year and for building calendar conversion tables.

2.1. The DATES module

2.1.a.

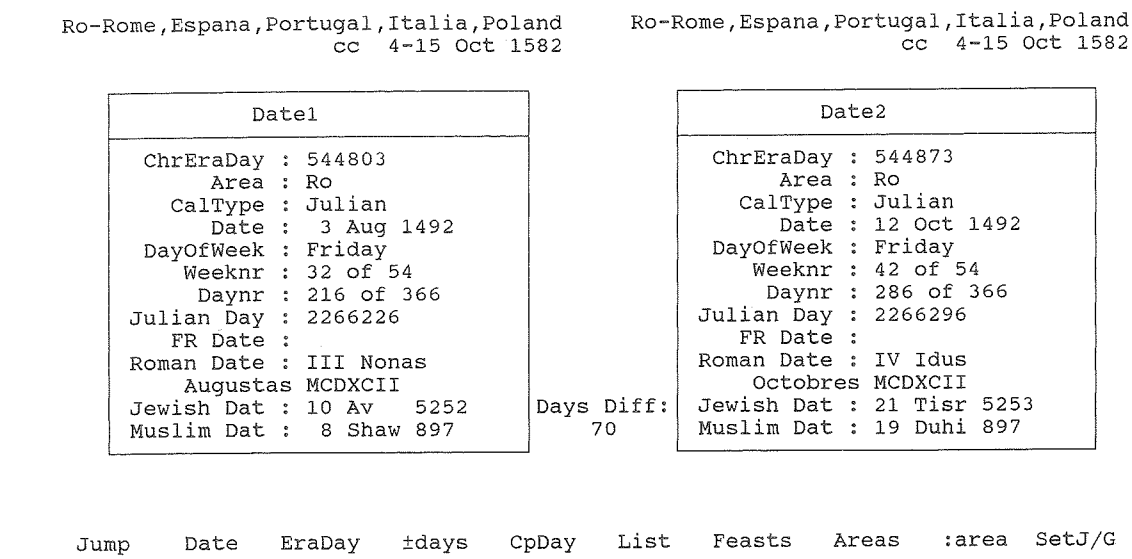
Figure 1 represents the PC screen when using the module Dates. At any time, two dates are visualised and the difference in days can be read between both windows. At the bottom of the screen a number of functions that can be used in this module are represented.

DATES accepts dates in Julian, Gregorian, French Revolution, Jewish and Muslim calendar format and shows the conversion to all of the other calendars. The day parameters are explained below:

ChrEraDay (Christian era day) is the day number in the Christian calendar, the exact number of days elapsed since 1 January AD.[4] Since during many centuries Julian and Gregorian calendars where used simultaneously in Europe, dates for a same astronomical day can be different from country to country. The day number however is the same everywhere.

Area: represents (by using a code) the area to which the date applies. Countries or provinces that changed from Julian to Gregorian calendar at the same time belong to a same area. The Code En, for example, represents England and its colonies and Ireland, while the code Ro represents Rome and the countries that introduced the Gregorian calendar at the same time as in Rome. The names of countries and provinces of a same area and the

Figure 1.



date of last Julian and first Gregorian date, are always represented at the top of the screen.

CalType: (Calendar Type) represents the type of calendar (Julian, Gregorian or both for a calendar change year) in use in that time in that area.

Date: is the date according to the Christian era. The year is always expressed according to the Stylus Circumcisionis (New Year at 1 January).

DayOfWeek: is the day of the week (from Monday to Sunday). For dates in the French Revolution Calendar period, the French Revolution week day name is also displayed (e.g. primidi, duodi, etc.).

Weeknr: (Week Number) is the number of the week in the current year. A week is considered to start with Monday.

Daynr: (Day Number) is the number of the day in the current year (between 1 and 365/6).

Julian Day: this is the number of days elapsed since 1 January 4713 before Christ. This date was chosen by Joseph Scaliger (1540–1609) as a commencing day for an era based on days, because in that year a Metonic cycle of 19 years, a sun cycle of 28 years and an Indiction cycle of 15 years coincide. The Julian day is still used nowadays in astronomy. It always is 1721423 greater than the Christian Era Day.[5]

FR Date: (French Revolution Date) represents the corresponding dates in the French Republican calendar for dates in the interval 22 September 1792–31 December 1805.

Roman Date: this is the date expressed according to the Roman Republic calendar day numbering method.

Jewish Date: this is the corresponding date in the Jewish calendar, according to the calendar method developed by patriarch Hillel, and to be used with dates on or after 1 January 360 AD.

Muslim Date: this is the corresponding date in the Muslim calendar, and thus applicable to dates on or after 16 July 622 AD, the time of the migration of Muhammed, from Mecca to Medina.

2.1.b.

At the bottom of the screen, a menu of functions is displayed. Each function can be activated by hitting the key of the first character of the function name:

Jump: this function selects the other of the two windows.

Date: this enables the user to enter a different date in the currently selected window. All day parameters and the days difference with the date in the other window will be updated. For the Christian calendar the day should be entered according to Stylus Circumcisionis, (New Year at 1 January). Dates can also be entered as French Republican, Jewish or Muslim dates. Looking at the month name entered, the program knows what calendar is meant. This provides an easy way to convert dates from one calendar type to another.

Eraday: enables to enter a different Christian era day number instead of a calendar date.

+/- days: a different Christian era day can also be selected by entering a number of days to add to or subtract from the current day. Hitting the Left or Right arrow key changes the day to 1 day before or after the current day. The Up and Down arrow keys move the date by one week before or after. The PgUp and PgDn keys move the date by one month, and the Home and End keys by one year.

CpDay: copies the day from the current window to the other window.

List: enables to view a number of chronology lists. Abbreviations used in a list are displayed on top of the screen. There are several lists: a list of Easter dates before 878 AD, that do not conform to the Julian Easter calculation rule, a list of countries and provinces with the periods in which a particular New Year Style was applied. The weekday name and month name list give 142 alternative day of week names and 285 alternative month names, used in national languages such as Latin, English, French, German and Dutch and also in several regional languages such as Breton, Anglo-Saxon, Irish, Provençal, etc. There are also lists for Popes, Kings of France, Britain and Germany that give the names of the rulers (in four different languages) with the dates of their election, enthronement, deposition, renunciation, death, burial etc. Finally there are also two annotated text files, based on what is written in the *Encyclopeadia Britannica* under the word Calendar.

Feasts: displays 64 moveable religious feasts with 210 names in 5 different languages.

Areas: displays the countries and provinces in 40 areas that switched from the Julian to the Gregorian calendar at the same time, mentioning also the last Julian date and the first Gregorian date.

:area: this function is used to switch to a different calendar area.

SetJ/G: this function enables you to enter the last Julian date of a user-defined calendar area. The number of days to be skipped for the switch to the Gregorian calendar is calculated by the program. This user-defined area can be saved for later use.

2.2. The CALENDR module

2.2.a.

Figure 2 is an image of the PC screen when using the Calendr module. It represents a calendar for half a year. The active year is displayed in the upper right corner. The active calendar area is displayed in the top line of the screen. In case of a calendar change year, the skipping of the days can be seen in the calendar (the skipped days are left out), as in the 1582 calendar for area Rome (see the October box). Also, for a leap year, the leap day (29 February or the first of two 24 February for the Julian calendar, see Figure 3) is highlighted. In the right column of the screen, the type of calendar (Julian, Gregorian or both) and the dates of the three most important Christian religious feasts (Easter, Ascension and Pentecost) are displayed. For the Julian calendar a number of year parameters used by medieval computists are displayed, (as in Figure 3) such as: Sunday Letter, Epact, Indiction before 1 Sep, Golden Number, the year number in the 19-year Moon cycle, the year number in the 28-year Sun cycle, the year in the 532-year Easter cycle, the Concurrentes, Regulares Paschae, Terminus Paschalis and Clavis Terminorum. For the Gregorian calendar these parameters are replaced by the number to add to the day in the month number to obtain the Christian Era day.

2.2.b.

The menu line at the bottom of the screen displays the functions that can be used by hitting the first character of the function name:

Jump: selects the other half of the year.

Figure 2.

```
Ro-Rome,Espana,Portugal,Italia,Poland                    cc  4-15 Oct 1582

 1582          7:July          26:31   8:August        31:35   9:Septembr      35:39
                Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su
 Jul/Greg                        1                1  2  3  4  5                  1  2
 Easter Ap 15    2  3  4  5  6  7  8    6  7  8  9 10 11 12    3  4  5  6  7  8  9
 Ascens My 24    9 10 11 12 13 14 15   13 14 15 16 17 18 19   10 11 12 13 14 15 16
 Pentec Jn  3   16 17 18 19 20 21 22   20 21 22 23 24 25 26   17 18 19 20 21 22 23
                23 24 25 26 27 28 29   27 28 29 30 31         24 25 26 27 28 29 30
 SundayLt G +C  30 31
 Epact      25
                10:October      40:42   11:November     43:47   12:December     47:51
                Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su
 Jl + 577641     1  2  3  4 15 16 17    1  2  3  4  5  6  7             1  2  3  4  5
 Au + 577672    18 19 20 21 22 23 24    8  9 10 11 12 13 14    6  7  8  9 10 11 12
 Se + 577703    25 26 27 28 29 30 31   15 16 17 18 19 20 21   13 14 15 16 17 18 19
 Oc + 577733                           22 23 24 25 26 27 28   20 21 22 23 24 25 26
 No + 577754                           29 30                  27 28 29 30 31
 De + 577784

          Jump    Year    ±yrs    List    Feasts    Areas    :area    SetJ/G
```

Figure 3.

```
Ro-Rome,Espana,Portugal,Italia,Poland                    cc  4-15 Oct 1582

 1540          1:January       1: 5    2:February      5: 9    3:March        10:14
                Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su
 Julian                  1  2  3  4                          1    1  2  3  4  5  6  7
 Easter Ma 28    5  6  7  8  9 10 11    2  3  4  5  6  7  8    8  9 10 11 12 13 14
 Ascens My  6   12 13 14 15 16 17 18    9 10 11 12 13 14 15   15 16 17 18 19 20 21
 Pentec My 16   19 20 21 22 23 24 25   16 17 18 19 20 21 22   22 23 24 25 26 27 28
                26 27 28 29 30 31      23 24 24 25 26 27 28   29 30 31
 SundayLt DC
 Epact      11
 Ind.<1Sep  13  4:April         14:18   5:May          18:23   6:June         23:27
 GoldenNr    2*  Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su    Mo Tu We Th Fr Sa Su
 MoonCycle  18                  1  2  3  4                1  2       1  2  3  4  5  6
 Sun Cycle   9   5  6  7  8  9 10 11    3  4  5  6  7  8  9    7  8  9 10 11 12 13
 Cy.Pasc. 477   12 13 14 15 16 17 18   10 11 12 13 14 15 16   14 15 16 17 18 19 20
 Concurr.    4  19 20 21 22 23 24 25   17 18 19 20 21 22 23   21 22 23 24 25 26 27
 Reg.Pasc.   1  26 27 28 29 30         24 25 26 27 28 29 30   28 29 30
 TmPasc Ma  25                        31
 Clav.Tm.   15

          Jump    Year    ±yrs    List    Feasts    Areas    :area    SetJ/G
```

Year: enables you to select another year.

+/- year: enables to select another year by entering a number of years to add to (+) or subtract (-) from the currently selected year.

List, Feasts, Areas, :area, SetJ/G are the same functions as described in the module Dates.

To make a hard copy of a full year calendar, one can use the standard PC Print Screen function for both of the half years.

2.3. Examples of use

The discovery of America

See Figure 1. On 3 August 1492, Columbus left the harbour of Palos (Spain) to search for India. He landed in the Bahamas in the morning of 12 October. How long had he been on his journey and on what day of the week did he leave and arrive? By entering the starting and arriving date in the two windows, one can see that Columbus was on sea precisely ten weeks (70 days) and that he arrived on a same weekday as he left, that is on a Friday.

A fast trip to become a king

See Figure 4. In 1688, the British invited William III of Orange, Stadtholder of Holland, to become their king. William left Holland on 11 November 1688 and landed in Torbay, England on 5 November. So he seems to have sailed very fast, since he arrived 6 days before he left. The negative date difference is of course only due to the difference of calendars in use. Anglican England had not accepted the Papal calendar reform, but Holland already had. 15 November 1688 Gregorian corresponds to 5 November 1688 Julian. This can be seen by entering 15 November 1688 in the first window (area Nh), copying the day to the other window (using CpDay) and setting the calendar area for the second window to En.

The Mysterious Easter Island

On Easter 1722 the Dutch sailor Jacob Roggeveen landed on a mysterious island in the Pacific Ocean, and named it Easter Island, which explains its name. On what day and month did he discover the island? Using the module Calendr and entering the year 1722 with area Nh (Netherlands: Holland) selected, one will find that Easter was celebrated on 5 April.

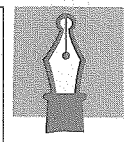
Would the name have been any different if the island had been discovered by an Englishman? England at that time still used the Julian calendar. Using the Dates module, entering 5 April 1722 in the left window (area Nh), copying to the right window (using CpDay) and setting the area to En,

Figure 4.

```
Nh-Nederlanden: Holland                          En-England and colonies, Ireland
                    cc  1-12 Jan 1583                              cc  2-14 Sep 1752

          Date1                                          Date2
 ChrEraDay : 616486                              ChrEraDay : 616486
      Area : Nh                                       Area : En
   CalType : Gregorian                             CalType : Julian
      Date : 15 Nov 1688                              Date :  5 Nov 1688
 DayOfWeek : Monday                              DayOfWeek : Monday
    Weeknr : 47 of 53                               Weeknr : 46 of 54
     Daynr : 320 of 366                              Daynr : 310 of 366
Julian Day : 2337909                            Julian Day : 2337909
   FR Date :                                       FR Date :
Roman Date : Nonis                              Roman Date : Nonis
 Novembribus MDCLXXXVIII                         Novembribus MDCLXXXVIII
Jewish Dat : 22 Hesv 5449    Days Diff:         Jewish Dat : 22 Hesv 5449
Muslim Dat : 21 Muha 1100         0             Muslim Dat : 21 Muha 1100

 Jump    Date    EraDay   ±days   CpDay   List   Feasts   Areas   :area   SetJ/G
```



reveals that the corresponding date is 25 March. But 25 March was Lady Day in England, a date which usually marked the start of the accounting year. (The British still get their income tax forms around that date!) See Figure 5. So, if an English sailor would have discovered the island, he might well have called the island Lady Day Island or named it after his landlord or his tax collector.

By the way, when did England celebrate Easter in that year? To discover this, use the Feasts function (see Figure 6) (with the right window, that is the one with area En active). Surprise again: Easter is 25 March. As we know, the calculation rules for Easter are different in the Julian and Gregorian calendar. That both coincide and moreover coincide with Englands Lady Day is very

Figure 5.

```
Nh-Nederlanden: Holland                    En-England and colonies, Ireland
                    cc  1-12 Jan 1583                          cc  2-14 Sep 1752

┌──────────────────────────┐                ┌──────────────────────────┐
│          Date1           │                │          Date2           │
├──────────────────────────┤                ├──────────────────────────┤
│  ChrEraDay : 628679      │                │  ChrEraDay : 628679      │
│       Area : Nh          │                │       Area : En          │
│    CalType : Gregorian   │                │    CalType : Julian      │
│       Date :  5 Apr 1722 │                │       Date : 25 Mar 1722 │
│  DayOfWeek : Sunday      │                │  DayOfWeek : Sunday      │
│     Weeknr : 14 of 53    │                │     Weeknr : 12 of 53    │
│      Daynr :  95 of 365  │                │      Daynr :  84 of 365  │
│ Julian Day : 2350102     │                │ Julian Day : 2350102     │
│    FR Date :             │                │    FR Date :             │
│ Roman Date : VIII Kalendas│               │ Roman Date : VIII Kalendas│
│      Apriles MDCCXXII    │                │      Apriles MDCCXXII    │
│ Jewish Dat : 18 Nisa 5482│ Days Diff:     │ Jewish Dat : 18 Nisa 5482│
│ Muslim Dat : 18 JmAk 1134│      0         │ Muslim Dat : 18 JmAk 1134│
└──────────────────────────┘                └──────────────────────────┘

 Jump    Date    EraDay   ±days   CpDay   List   Feasts   Areas   :area  SetJ/G
```

Figure 6.

```
          (3rd Sunday before Easter)
          =MiCarême(F)=Mitt-,Halbfasten,Rosensonntag(D)=Halfvasten(N)
 Mar 11   Passion,Black-,CarleSunday(E)='Iudica me deus'(L)
          (2nd Sunday before Easter)
          =Passion(F)=Passions-,Namenloser-,SchwarzerSonntag(D)=Passiezondag(N)
 Mar 18   Palm-,PardonSunday(E)=Palmarum,DomenicaOlivarum,-Osanna,-AdPalmas,
          PaschaFlorum,-Competentium,-Floridum,ClausumPasche(L)
          (Sunday before Easter)
          =DimancheDesRameaux,-DesPâquesFleuries(F)=Palmsonntag,Eselsfest,
          Palmeseltag(D)=Palmzondag(N)
 Mar 19   HolyMonday(E)
 Mar 20   HolyTuesday(E)
 Mar 21   HolyWednesday(E)=Krumme-,PlatzMittwoch(D)=SchortelWoensdag(N)
 Mar 22   Holy-,Maundy-,ChareThursday(E)
          =JeudiSaint,-Blanc,-Absolu,-Grand(F)=Mendel-,Antlasstag,Gräner-,
          WeisserDonnerstag(D)=WitteDonderdag(N)
 Mar 23   Good-,Holy-,LongFriday(E)=AdoratioCrucis(L)
          =VendrediSaint,-Adoré(F)=Kar-,Stiller-,Langer-,SchmerzensFreitag(D)
          =GoedeVrijdag(N)
 Mar 24   HolySaturday(E)=SabbatumPasche,-Sanctum(L)
          =GrandSamedi,SamediSaint,-DesFontsBénis(F)=Kar-,Hoher-,TaufSamstag(D)
          =Paaszaterdag(N)
 Mar 25   Easter(E)=Pascha,'Resurrexi'(L)
          =Pâques(F)=Ostern,Paschen(D)=Pasen(N)
 FEASTS.DAT    Quit   Contnue  Redo   Search
```

exceptional. From the 1200s to 1752 (the period in which England used 25 March as the starting day of the year) this particular situation only exists in 1627, 1638, 1649, 1722, 1733 and 1744. So after all, an English sailor might have called the mysterious island Easter Island as well . . .

2.4. The TABLES module

This module permits the building of calendar conversion tables in any combination thinkable. The tables can be viewed on the screen, sent to the printer or sent to a file on disk. The specifications for two tables can be made in two windows on the screen.

The starting and ending dates can be specified in the first two lines of a Tables window. To shorten tables, one can specify a day step, which is the distance in number of days between two following lines in the table. A table with a step of 10 days diminishes the amount of paper produced, while remaining easy to use, since only a small arithmetic interpolation is needed to read the conversion of a particular date. Each line in the table can have from two to four columns. The columns can be choosen from: Christian calendar (specified by the calendar area), day of the week, daynumber (Christian Era Day or Scaliger's Julian Day), Julian calendar with Roman Republican day numbering, French Republican calendar, Jewish and Muslim calendar. One can also specify the height and width of the paper. At any time during the entering of the table parameters, the program computes the width of one table line and the number of pages needed to print the whole table in the bottom two lines of the window.

2.5. Example of use

As an example a concise table of the French Revolution calendar was built, using a step of 30 days. (see Figures 7 and 8).

HISTCAL is available from the author, P. Donche, Elisabethlaan 2/34, B-2600 Berchem, Belgium for $ 85 (£ 50, FF 500, BEF 3000, Hfl 165, SF 125, DM 150) by sending a cheque (preferably Eurocheque) or by VISA Card. The package includes a manual with many examples.

Figure 7.

```
          Table1
 First Date : 22 Sep  1792
  Last Date : 14 Mar  1806
       Step :    30 days
1st column : Fr.Rev.Date
2nd column : Ro-Rome,Espana,P
3rd column : Not used
4th column : Not used
    Output : printer or file
Tab Height :    57 lines
Page Width :    80 columns
 PageLayout :  3x 25 + 2 = 77
 Nr.ofPages :     1
```

```
          Table2
 First Date : 26 Apr  1990
  Last Date : 26 Apr  1990
       Step :     1 days
1st column : Not used
2nd column : Not used
3rd column : Not used
4th column : Not used
    Output : screen
Tab Height :    64 lines
Page Width :    80 columns
 PageLayout :
 Nr.ofPages :  none
```

```
Jump   FstDat  LstDat   Step    1234   Output   Height  Width    Go    CpTab
```

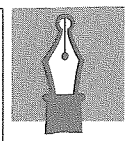


Figure 8.

1	Vend	1	22	Se	1792	10	Germ	5	30	Ma	1797	14	Vend	10	6	Oc	1801
1	Brum	1	22	Oc	1792	10	Flor	5	29	Ap	1797	14	Brum	10	5	No	1801
1	Frim	1	21	No	1792	10	Prai	5	29	My	1797	14	Frim	10	5	De	1801
1	Nivo	1	21	De	1792	10	Mess	5	28	Jn	1797	14	Nivo	10	4	Ja	1802
1	Pluv	1	20	Ja	1793	10	Ther	5	28	Jl	1797	14	Pluv	10	3	Fe	1802
1	Vent	1	19	Fe	1793	10	Fruc	5	27	Au	1797	14	Vent	10	5	Ma	1802
1	Germ	1	21	Ma	1793	5	Vend	6	26	Se	1797	14	Germ	10	4	Ap	1802
1	Flor	1	20	Ap	1793	5	Brum	6	26	Oc	1797	14	Flor	10	4	My	1802
1	Prai	1	20	My	1793	5	Frim	6	25	No	1797	14	Prai	10	3	Jn	1802
1	Mess	1	19	Jn	1793	5	Nivo	6	25	De	1797	14	Mess	10	3	Jl	1802
1	Ther	1	19	Jl	1793	5	Pluv	6	24	Ja	1798	14	Ther	10	2	Au	1802
1	Fruc	1	18	Au	1793	5	Vent	6	23	Fe	1798	14	Fruc	10	1	Se	1802
1	Comp	1	17	Se	1793	5	Germ	6	25	Ma	1798	9	Vend	11	1	Oc	1802
26	Vend	2	17	Oc	1793	5	Flor	6	24	Ap	1798	9	Brum	11	31	Oc	1802
26	Brum	2	16	No	1793	5	Prai	6	24	My	1798	9	Frim	11	30	No	1802
26	Frim	2	16	De	1793	5	Mess	6	23	Jn	1798	9	Nivo	11	30	De	1802
26	Nivo	2	15	Ja	1794	5	Ther	6	23	Jl	1798	9	Pluv	11	29	Ja	1803
26	Pluv	2	14	Fe	1794	5	Fruc	6	22	Au	1798	9	Vent	11	28	Fe	1803
26	Vent	2	16	Ma	1794	5	Comp	6	21	Se	1798	9	Germ	11	30	Ma	1803
26	Germ	2	15	Ap	1794	30	Vend	7	21	Oc	1798	9	Flor	11	29	Ap	1803
26	Flor	2	15	My	1794	30	Brum	7	20	No	1798	9	Prai	11	29	My	1803
26	Prai	2	14	Jn	1794	30	Frim	7	20	De	1798	9	Mess	11	28	Jn	1803
26	Mess	2	14	Jl	1794	30	Nivo	7	19	Ja	1799	9	Ther	11	28	Jl	1803
26	Ther	2	13	Au	1794	30	Pluv	7	18	Fe	1799	9	Fruc	11	27	Au	1803
26	Fruc	2	12	Se	1794	30	Vent	7	20	Ma	1799	3	Vend	12	26	Se	1803
21	Vend	3	12	Oc	1794	30	Germ	7	19	Ap	1799	3	Brum	12	26	Oc	1803
21	Brum	3	11	No	1794	30	Flor	7	19	My	1799	3	Frim	12	25	No	1803
21	Frim	3	11	De	1794	30	Prai	7	18	Jn	1799	3	Nivo	12	25	De	1803
21	Nivo	3	10	Ja	1795	30	Mess	7	18	Jl	1799	3	Pluv	12	24	Ja	1804
21	Pluv	3	9	Fe	1795	30	Ther	7	17	Au	1799	3	Vent	12	23	Fe	1804
21	Vent	3	11	Ma	1795	30	Fruc	7	16	Se	1799	3	Germ	12	24	Ma	1804
21	Germ	3	10	Ap	1795	24	Vend	8	16	Oc	1799	3	Flor	12	23	Ap	1804
21	Flor	3	10	My	1795	24	Brum	8	15	No	1799	3	Prai	12	23	My	1804
21	Prai	3	9	Jn	1795	24	Frim	8	15	De	1799	3	Mess	12	22	Jn	1804
21	Mess	3	9	Jl	1795	24	Nivo	8	14	Ja	1800	3	Ther	12	22	Jl	1804
21	Ther	3	8	Au	1795	24	Pluv	8	13	Fe	1800	3	Fruc	12	21	Au	1804
21	Fruc	3	7	Se	1795	24	Vent	8	15	Ma	1800	3	Comp	12	20	Se	1804
15	Vend	4	7	Oc	1795	24	Germ	8	14	Ap	1800	28	Vend	13	20	Oc	1804
15	Brum	4	6	No	1795	24	Flor	8	14	My	1800	28	Brum	13	19	No	1804
15	Frim	4	6	De	1795	24	Prai	8	13	Jn	1800	28	Frim	13	19	De	1804
15	Nivo	4	5	Ja	1796	24	Mess	8	13	Jl	1800	28	Nivo	13	18	Ja	1805
15	Pluv	4	4	Fe	1796	24	Ther	8	12	Au	1800	28	Pluv	13	17	Fe	1805
15	Vent	4	5	Ma	1796	24	Fruc	8	11	Se	1800	28	Vent	13	19	Ma	1805
15	Germ	4	4	Ap	1796	19	Vend	9	11	Oc	1800	28	Germ	13	18	Ap	1805
15	Flor	4	4	My	1796	19	Brum	9	10	No	1800	28	Flor	13	18	My	1805
15	Prai	4	3	Jn	1796	19	Frim	9	10	De	1800	28	Prai	13	17	Jn	1805
15	Mess	4	3	Jl	1796	19	Nivo	9	9	Ja	1801	28	Mess	13	17	Jl	1805
15	Ther	4	2	Au	1796	19	Pluv	9	8	Fe	1801	28	Ther	13	16	Au	1805
15	Fruc	4	1	Se	1796	19	Vent	9	10	Ma	1801	28	Fruc	13	15	Se	1805
10	Vend	5	1	Oc	1796	19	Germ	9	9	Ap	1801	23	Vend	14	15	Oc	1805
10	Brum	5	31	Oc	1796	19	Flor	9	9	My	1801	23	Brum	14	14	No	1805
10	Frim	5	30	No	1796	19	Prai	9	8	Jn	1801	23	Frim	14	14	De	1805
10	Nivo	5	30	De	1796	19	Mess	9	8	Jl	1801	unexisting			13	Ja	1806
10	Pluv	5	29	Ja	1797	19	Ther	9	7	Au	1801	unexisting			12	Fe	1806
10	Vent	5	28	Fe	1797	19	Fruc	9	6	Se	1801	unexisting			14	Ma	1806

Notes

[1] J. J. Scaliger, *De Emendatione Temporum* (1583). H. Grotefend, *Zeitrechnung des deutschen Mittelalters und der Neuzeit* (Hanover, 1891–92). F. K. Ginzel, *Handbuch der Mathematischen und Technischen Chronologie. Das Zeitrechnungswesen der Völker* (Leipzig, 1906, 1911 and 1914). E. Strubbe and L. Voet, *De Chronologie der Middeleeuwen en de Moderne tijden in de Nederlanden* (Antwerp, 1960).

[2] Ginzel, *Handbuch*, cit.

[3] This principle is mostly attributed to Joseph Scaliger. But he was not the first to see that this is the most efficient way to convert dates. Already in the ninth century, the Arab mathematician Mohammed ibn Musa al-Khowarizmi formulated this principle in his book on astronomy, the Kitab al-Sindhind. From the title of another of his works, the Kitab al-Jabr was derived the word algebra, and from his own name stems the word algorithm. (see H. Zemanek, 'Al-Khorezmi, his background, his personality, his work and his influence', in *Algorithms in Modern Mathematics and Computer Science*, ed. A. P. Ershov and D. E. Knuth, Lecture Notes in Computer Science, 122 (Springer-Verlag, Berlin, New York, 1981).

[4] More precisely, the exact number of days at 23hr 59 minutes 59 seconds elapsed since 1 January, 1 0hrs 0 minutes 0 seconds.

[5] The name Julian Day is misleading, since it has nothing to do with the Julian calendar, but was named after Julius Caesar Scaliger, the father of Joseph Scaliger. In the International Geophysical Year, the Julian day was standardised as the universal time scale, but simplified by dropping the first two digits (Modified Julian Day 0 is 17 November 1858 or Julian Day 2400001).