



# 11-823: Conlanging

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Numbers and Time

# *Numbers and Time*

- ◆ *Counting*
  - *Speech and Orthography*
- ◆ *Clocks*
  - *Representing time*
  - *(and Calendars)*
- ◆ *Building prompts for telling the time*

# Numbers

- ◆ *Counting (English)*
  - *One, two, three ...*
  - *Ten, eleven, twelve*
  - *Thirteen, fourteen, ...*
  - *Twenty, thirty, forty, ...*

# Numbers

## ◆ Counting (French)

- *Un, deux, trois, ...*
- *Dix, onze, douze, .. seize,*
- *Dix-sept, dix-huit, dix-neuf*
- *Vingt, trente, ...*
- *Quatre-vingt, quatre-vingt-dix*

# Numbers

## ◆ *Counting (Roman/Latin)*

- *I II III IV V VI VII VIII IX X*
- *X XI XII ... XIX*
- *XL*
- *MMXIV*
- *Unus, duo, tres, quattuor, quinque, sex, septem, octo, novem, decem*
- *Duedecem, viginti duo*
- *But they conjugate*

# Numbers

## ◆ *Counting (Chinese)*

- 一 二 三 四 五 六 七 八 九 十
- 十一 十四
- 二十 二十五

# Numbers

## ◆ *Counting (Japanese)*

- 一 二 三 四 五 六 七 八 九 十
- Ichi ni san shi/yon go roku shichi/nana hachi kyuu ju
- But counting things
- Hitotsu, futatsu, mittsu, yotsu, itsutsu, mutsu, nanatsu, yatsu, kokonotsu, tou
- But varies with shape/size of objects
- -mai (flat things), tou (large animals) hiki (small animals), satsu (books) hon (long round things) ...

# Numbers

## ◆ *Counting (English again)*

- Cardinal: one, two, three
- Ordinal: first, second, third, ...
- Adverbial: once, twice, thrice, quince
- Cardinal prefix: uni-, bi-, tri-, quad- ...
- Counters (cf Japanese)
  - Volumes (books), head (cattle), barrels (oil), sheets (paper/flat things), ...



# *Numbers General*

- ◆ *1, 2, (3) might irregular*
- ◆ *11, 12 might be irregular*
- ◆ *11-19 might be irregular*
- ◆ *5 based, 10 based (20 based)*
- ◆ *Might use “minus” e.g. IX*
- ◆ *Might have superstitious name changes*
- ◆ *Etymology often goes to older language*
  - (i.e. numbers are long term, stable and for geeks)

# *Numbers base*

- ◆ *Base 10, or not ...*
- ◆ *4 gills in an ounce*
- ◆ *16 ounces in a pound*
- ◆ *14 pounds in a stone*
- ◆ *8 stone in a hundredweight (112lb)*
- ◆ *20 hundredweight in a ton*
- ◆ *Different people/professions use different magnitudes of measures*

# *Numbers base*

- ◆ *12 inches in a foot*
- ◆ *3 feet in a yard*
- ◆ *22 yards in a chain*
- ◆ *10 chains in a furlong*
- ◆ *8 furlongs in a fortnight*

# *Numbers base*

- ◆ *12 inches in a foot*
- ◆ *3 feet in a yard*
- ◆ *22 yards in a chain*
- ◆ *10 chains in a furlong*
- ◆ *8 furlongs in a mile*
  
- ◆ *Depends on the required accuracy:  
astronomical units, light years, ...*

# *Numbers +*

- ◆ *Zero*
- ◆ *Negative numbers*
- ◆ *Fractions are common, decimals are later*
- ◆ *50% 5分 half*
- ◆ *Transcendental Numbers: Pi e i*
- ◆  *$1+2+3+4+\dots = -1/12$*

# *Time*

## ◆ *Key notions*

- *Sunrise, Sunset, noon*
- *Solstices and equinoxes*
- *Quarterdays (Lady Day and Michaelmas)*  
*(for taxes)*
- *Mo(o)nths 月 (from Sanskrit ?)*

## ◆ *Years (365.25ish days)*

- *Kings, Empires, start of time*
- *Stardate (Star Trek, Julian Days)*

# *Years/Calendar*

- ◆ *Often Lunar based*
  - *Becomes out of sync with seasons*
- ◆ *Julian Calendar/Gregorian Calendar*
  - *Pope Gregory 1582*
  - *England (and her colonies) changed*
    - *2nd September 1752*
- ◆ *Year start is hard to know*
  - *23rd January 1314*
  - *700 or 699 years ago (OS/NS)*
- ◆ *UK tax year is still Julian Calendar based(ish)*
  - *6<sup>th</sup> April*

# *Sundial*

- ◆ *Measure time from sun movement*
  - *Only good during the day*
  - *Was the definition of time*
  - *But its not uniform*
  - *Noon varies with longitude*
- ◆ *Half time from sunset to noon, but varies:*
  - *With latitude and time of year*
- ◆ *Split into units*
  - *12 or 24 (easy for fractions)*
  - *Hour/Hora is a cognate with Sanskrit*



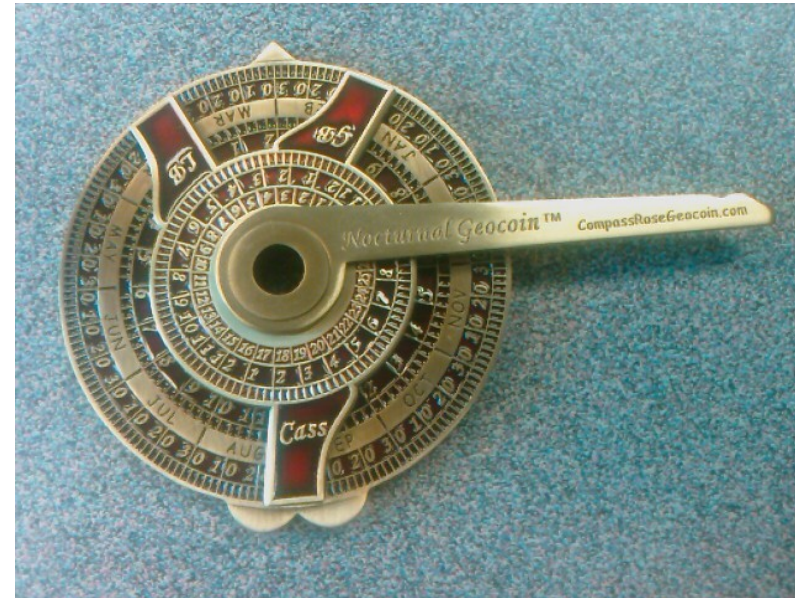
# *Portable Sundial*



# *(no)Sun dial*

*Nocturnal*

*Position of Cassiopea  
Around pole star*



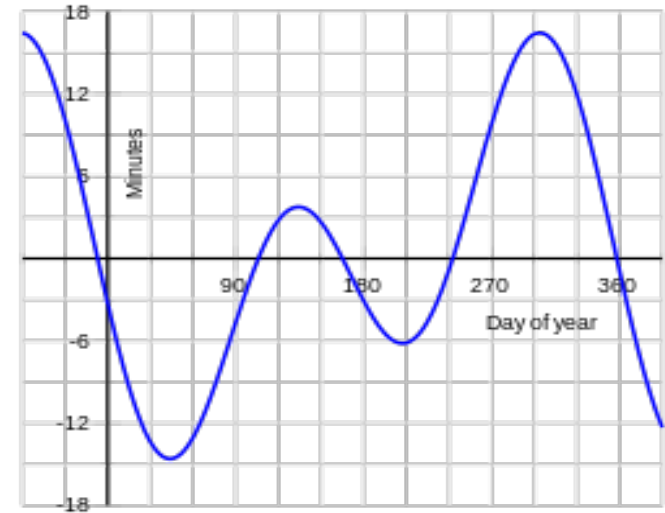
*No Sun (Scotland/Scandinavia)*

*Sunstone: prism/crystal  
that finds sun's position  
behind clouds*



# Equation of Time

- ◆ *[But sun-time isn't accurate]*
- ◆ *But mechanical clocks don't match the sun*
- ◆ *Equation of time to correct mechanical clocks*
- ◆ *Now used to correct sundials*
- ◆ *Mismatch due to earths elliptical orbit*



# *“Modern” Time*

- ◆ *Lots of archaic hold overs*
  - *O'clock*
  - *a.m. and p.m (ante-meridian, post-meridian)*
- ◆ *Romans used*
  - *“3 hours a.m.” to mean 09:00*
- ◆ *12 or 24 hours*
  - *Early mechanical clocks were 24 based*

# *Convenient Expressions*

- ◆ *24 hour clock*
  - *03:15 oh three fifteen*
- ◆ *In speech its usually more colloquial*
  - *03:15*
  - *Three fifteen*
  - *Quarter past three in the morning*
- ◆ *Different standards*
  - *“til”/”to” (US/UK)*
  - *“half five” is 4:30 or 5:30*

# *Divisions of the Day*

- ◆ *English standard*

- *In the morning*
- *In the afternoon*
- *In the evening*
- *At night*
- *Used to discriminate confusable times*

- ◆ *Other languages*

- *“Prayer” times*
- *Sun up/down times*

# *Building a talking clock*

- ◆ *What will it say:*
- ◆ *“The time is now, about five past one in the morning”*
- ◆ *Generate 12 or 24 utterances from a basic template*
- ◆ *Carrier sentences are good*
  - *Makes speaker speak better*
  - *Makes listener adapt before key information*

# *Building a talking clock*

- ◆ *Design your carrier phrase*
- ◆ *Plug in each of your actual values*
- ◆ *Don't to minimize the recordings*
  - *Better to have word examples multiple times*
- ◆ *Should have word coverage*
  - *Basic techniques wont allow synthesis of new conjugations*



# *Homework for Fri 31st*

- ◆ *Submitted by email by noon to [awb@cs.cmu.edu](mailto:awb@cs.cmu.edu)*
- ◆ *Name of your language*
- ◆ *Short background about your language*
- ◆ *List of prompts you will record*
- ◆ *List of phonemes you will use*
- ◆ *List of word pronunciations*
- ◆ *Write up with gloss of prompt(s) and explanation of other decisions you have made*

# *Building a voice*

- ◆ *Create prompts, lexicon and phonemes*
- ◆ *Record each prompt*
  - *16KHz mono riff/.wav format*
- ◆ *Provide phone mapping to English like phones*
  - *To allow automatic alignment for phones*
- ◆ *Extract spectral and prosodic features*
  - *Mfcc's and Pitch*
- ◆ *Build utterance structures*
  - *With aligned durations*
- ◆ *Build limited domain cluster unit selection synthesizer*
  - *Test it actually works*

# *Optional*

- ◆ *Function to map 24hr clock to your textual description*
  - *03:14 → “the time is now almost quarter past three in the morning”*
  - *This can be done in Festival (or any other programming language and have it call Festival to generate the waveform file*

*Final built (working) talking clock will be due Feb 7<sup>th</sup> at noon*

