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On averaging

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Historical aside: Leonhard Euler

Swiss mathematician/physicist, 1707–1783

- Possibly most prolific author in any field; collected works > 80 vol.
- Number theory, analysis, mathematical physics...
- Notation: $f(x)$, $\sin x$, $\cos x$, e, $\sum$
- $e^{\pi i} + 1 = 0$
- Used Fourier series, Bessel functions, Laplace transforms—*before F, B & L were born*

- Polymath: knew Virgil's *Aenid* by heart, well-versed in medicine, botany, geography
- "The Shakespeare of mathematics"
- Total blindness for last 17 yr, but his output *increased*

Euler on averaging

In the course of a study of the orbits of Jupiter and Saturn, requiring estimating 7 parameters using 75 observations:

> *"By the combination of two or more equations, the errors of the observations and of the calculations can multiply themselves."*
>
> — *Euler, 1749*

Tobias Mayer (German lunar astronomer), and later, Laplace, would advocate averaging, based on practical experience of seeing errors tending to cancel, & Bayesian reasoning