

skyscapeR: Data Analysis and Visualisation for Skyscape Archaeology

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skyscapeR is a free, open-source package for the R software environment for statistical computing and graphics that specialises in data reduction, visualisation and analysis in skyscape archaeology. It is intended to be a fully-fledged, transparent and peer-reviewed package offering a robust set of quantitative methods while retaining simplicity of use. New users can explore the package's features using the vignette accessible from its website (Silva 2021). Among others, the package includes simple functions to

- create polar plots of azimuth measurements (function **plotAzimuth**);
- calculate declination from field measurements while taking into account atmospheric refraction (**az2dec**);
- calculate the declination of key solar and lunar events (such as lunar extremes, solstices and zenith passages) for any location and time period (functions **jS**, **dS**, **nMjLX**, **nmnLX**, **smnLX**, **sMjLx**, **zenith** and **antizenith**);
- calculate the position of celestial objects in the sky for any location and timestamp (**body.position**);
- correct compass measurements for magnetic declination (function **reduct.compass**) automatically, as well as theodolite measurements for the sun-sight method (**reduct.theodolite**); and
- create and retrieve HeyWhatsThat (Kosowsky 2021) horizon profiles automatically (functions **createHWT** and **downloadHWT**), as well as convert them into a format ready to be used with Stellarium (**exportHor**).

Version 1.0.0 was recently released on CRAN – The Comprehensive R Archive Network – and is also available on the author's GitHub page (Silva 2021). This version solves several problems that led to the previous version becoming unavailable on CRAN, fixes several other bugs and implements the *swephR* package as the new ephemeris engine for all

celestial computations (Reijs and Stubner 2020). It also implements the probabilistic framework and statistical significance test developed elsewhere (Silva 2020).

New or revised functionalities include:

- the ability to list all celestial targets for a given declination range and time period automatically (**findTargets**);
- the estimation of star phases, events and their seasonality (**star.phases**);
- the probabilistic framework and statistical significance test (functions **az.pdf**, **coordtrans**, **spd** and **randomTest**);
- the calculation of a p-value using the Bernoulli trial (**bernoulli.trial**);
- the production of a simplistic sketch of the sky for a given location and time (**sky.sketch**);
- the calculation of the declination for the spatial definition of equinox (**spatial.equinox**); and
- the calculation of equinoctial Full Moons (**EFM**).

skyscapeR started off as a webpage for students of the Sophia Centre's MA in Cultural Astronomy and Astrology to perform archaeoastronomical calculations without having to learn statistics, trigonometry or coding. From those humble beginnings as a graphical front-end for a series of functions I had developed for my own research, it has evolved into a robust package ready to be shared with the world. It is my hope that it will not only be useful to other researchers in skyscape archaeology, but that others may wish to contribute with more functionality. The field could certainly do with a community-built standard methodological toolkit.

References

- Kosowsky, M., 2021. HeyWhatsThat [online]. Accessed October 2021, <http://www.heywhatsthat.com>
- Reijs, V. and R. Stubner, 2020. "Swiss Ephemeris: An Accurate Ephemeris Toolset for Astronomy and Astrology". *Journal of Skyscape Archaeology* 6 (1): 150-154. <https://doi.org/0.1558/jsa.42323>
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