

## Yangkyongkyuil-ui(兩景揆日儀): A Sundial Composed of Four-piece Vertical Planes

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A four piece vertical plane-type sundial *yangkyongkyu-ilui*(兩景揆日儀) which was made by Korean mathematician Sang-hyok Lee in 1850 was investigated and reconstructed. The method of making and usage were described in the book *Kyuil-go*(揆日考, seven double-pages)(*On Measuring the Sun*) written by Lee Sang-hyok(李尙爨) and modified version is also described in *Collected Papers in Scientific Instruments, uigi-jipsol*(儀器輯說) edited by Nam Byong-chol(南秉哲) around late 1850's. According to the descriptions of *kyuil-go*(揆日考), the instrument was a kind of portable sundial composed of four bronze(or wooden) square plates and a horizontal gnomon(空表). The two plates are parallel or horizontal(橫版) and the rest two are vertical(立版). When the four plates are combined, they form a single big plate which lies in the vertical plane. On one side of the combined plates, there are thirty seven parallel lines, indicating the twenty four seasons, and thirty slanted curves indicating twelve double-hours on it. We have revived the curves on the plates of *Yangkyongkyuil-ui* based on the descriptions in the book. To do this, we draw first 72 parallel lines which is 3 times of the 24 fortnightly seasons. After that we draw 30 slanted curves by computing the length of the hour lines. The combined plate of four plates is divided into two pieces and each piece expresses curves fortnightly seasons from the beginning of the winter solstice to the summer solstice, and the other for the rest of the year. When one want to measure local time it is necessary only bringing the plate to the corresponding season. For the use of the sundial, in general, it is necessary to align the instrument exactly to the north-south direction. Therefore, unless the exact directions are known, it is difficult to measure time accurately. On the other hand, *Yangkyongkyuil-ui* is easy to uses by simply directing the instrument towards the sun at the moment of time measurement. This is because its gnomon is a plane-type not a typical needle-type used ordinary sunndial, and thus it is easy to direct the instrument by making the edge of the casted shadow parallel to the plane of the vertical plates. We found that the instrument is equivalent to the Pillar, Cylinder or Shepherd-type sundial used by Europeans until 20th century.