

Influence of outdoor thermal environment on shaded or sunlit walking path selection of pedestrian



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When the sun is strong in summer, pedestrians would prefer to walk on shaded path to reduce thermal discomfort and/or protect the skin from the UV rays in urban street. On the other hand, pedestrians may prefer to walk on sunlit path in winter. This study analyzed influence of outdoor thermal environment on shaded or sunlit walking path selection on pedestrian through a whole year.

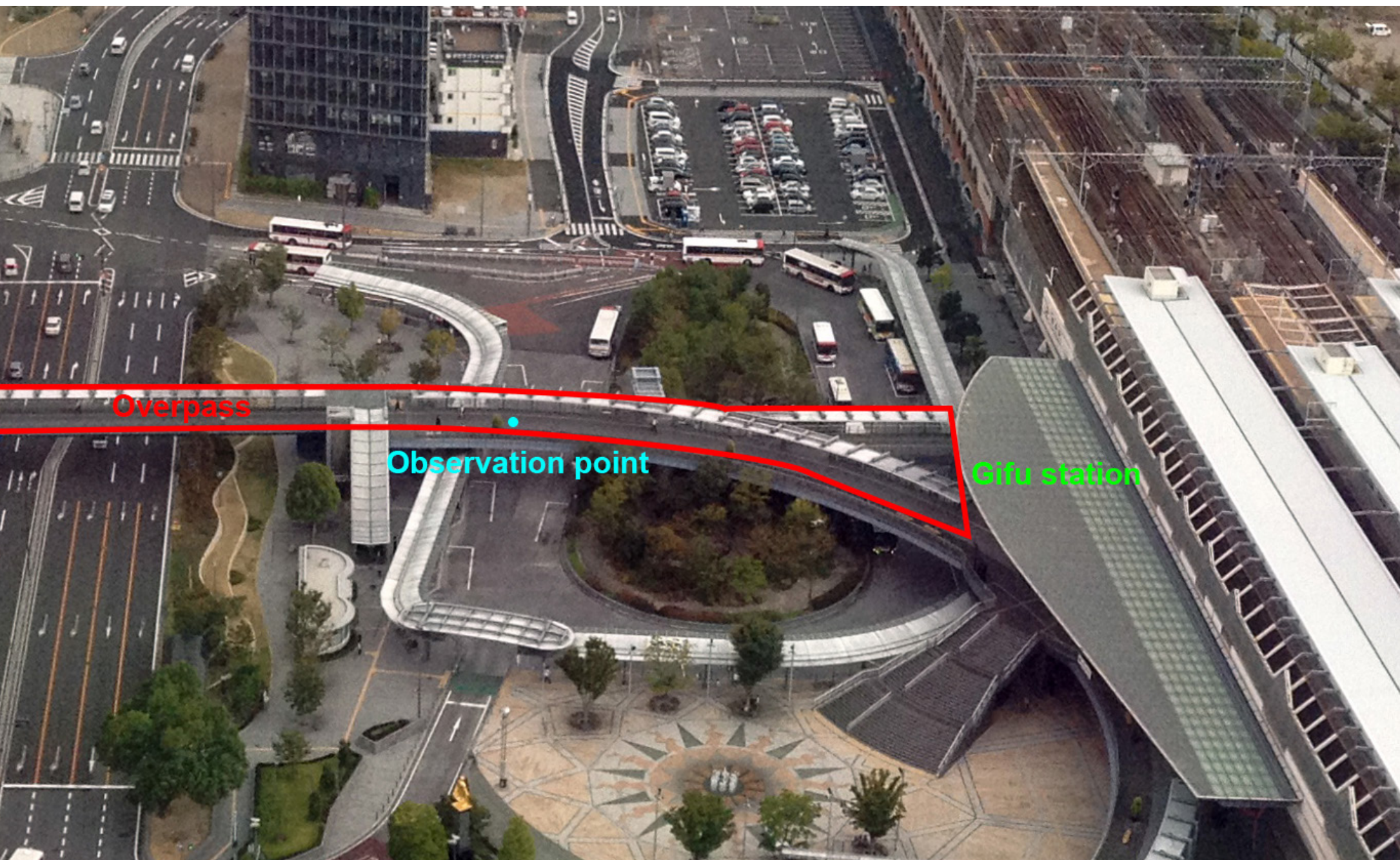


Fig. 1 Bird's-eye view of study area.

This study chose a pedestrian overpass with shading devices, located in the heart of Gifu City central Japan. The overpass lies mostly north-south and joins a rail station (Gifu station) concourse at the end of south. The shading devices covers half area of the overpass, thus pedestrians can select which walking on shaded path or walking on sunlit path around noon.

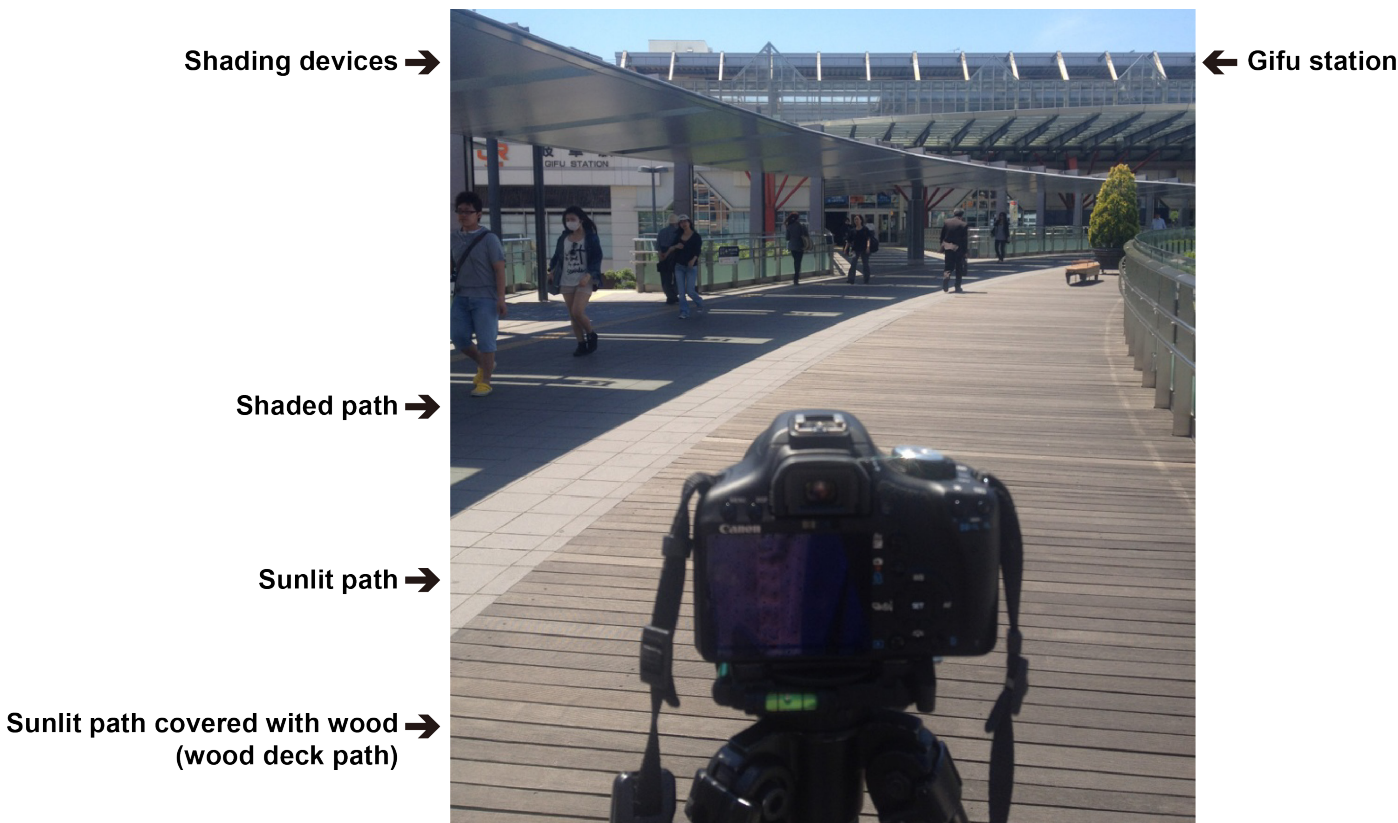


Fig. 2 Location of observation.

The number of pedestrians which walking on shaded path or sunlit path was calculated using the photographs. The observations were

conducted on a clear day and weekday from 6 June 2013 to 6 June 2014 at intervals of approximately 15 days. The time of observation was from 12:30 to 14:00.

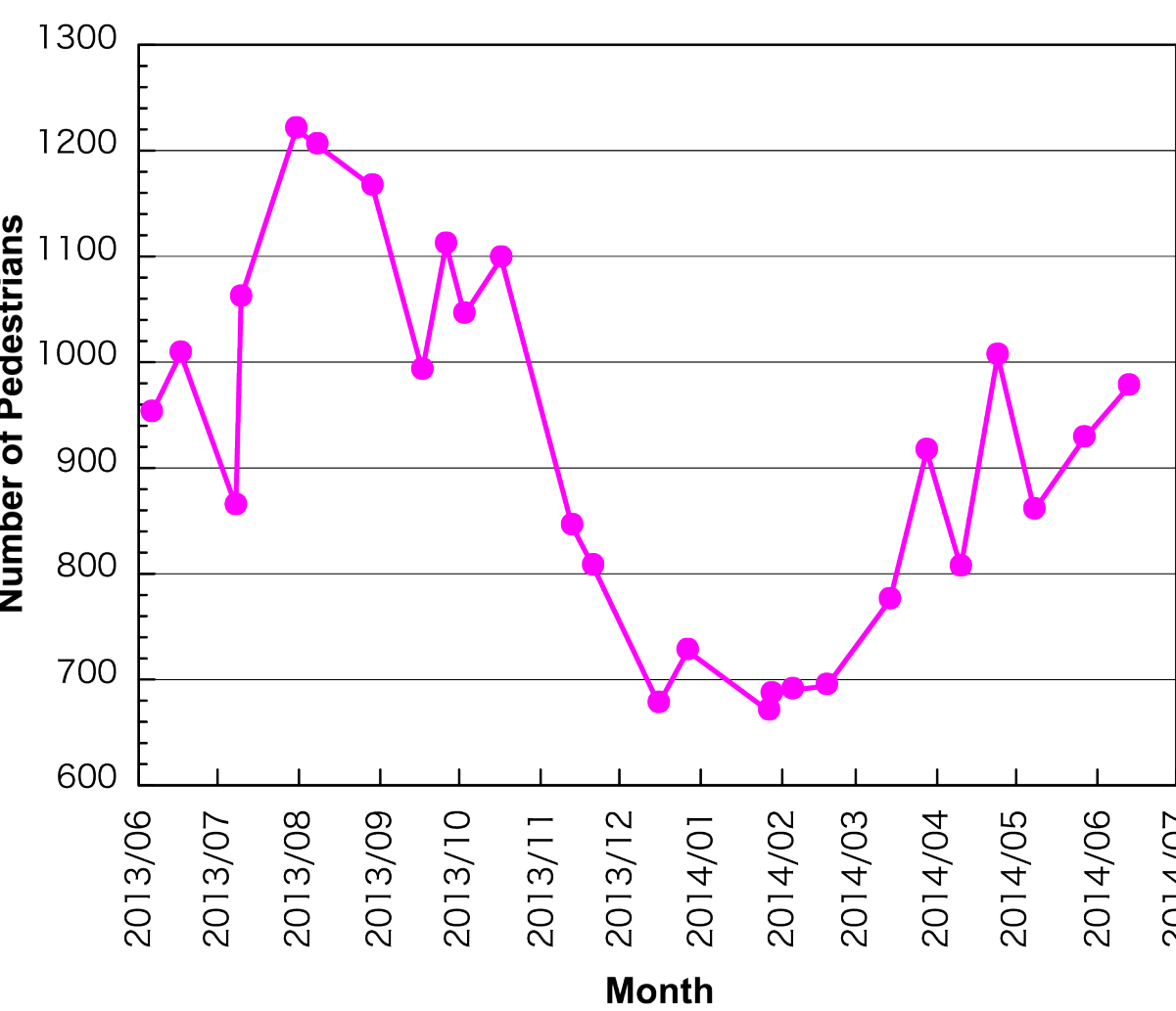


Fig. 3 Number of pedestrians walking on the overpass.

The highest number of pedestrians was 1220 in 31 July 2013 and the lowest number was 670 in 27 January

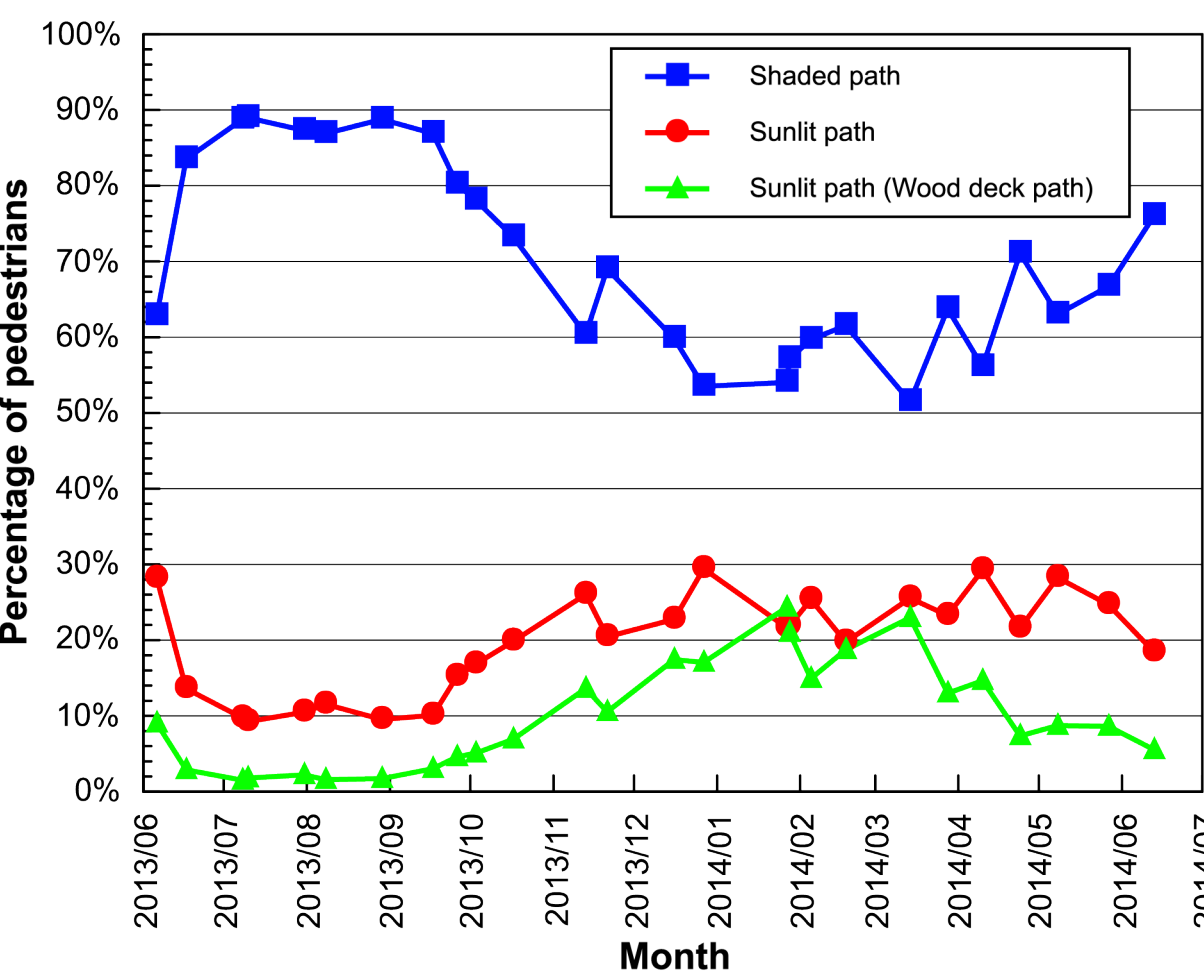


Fig. 4 Percentage of each path selection by the pedestrians.

Around 90% of pedestrians selected shaded path from July to September. Subsequently, the percentage of shaded path

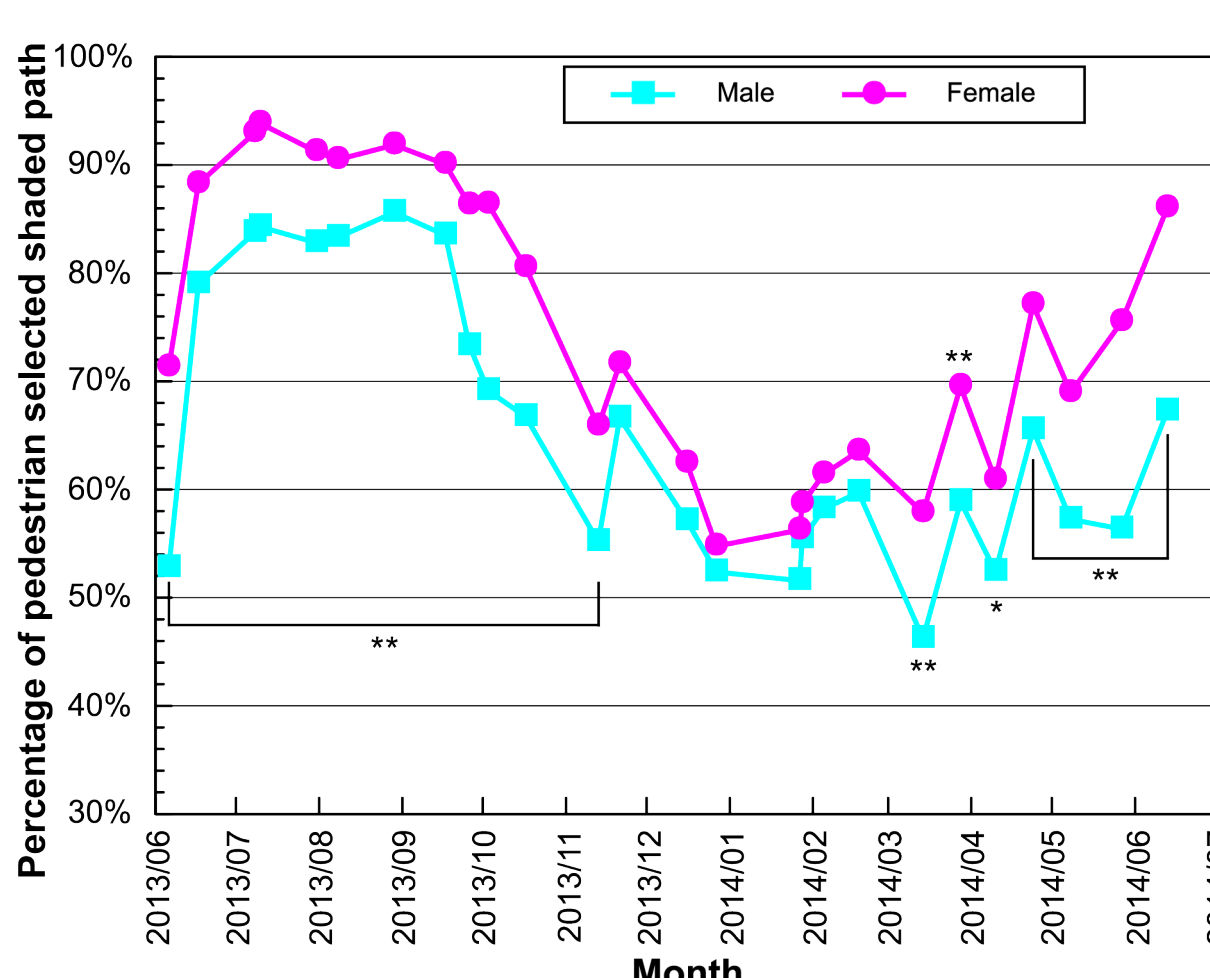


Fig. 5 Comparison of shaded path selection between male and female. (** $p < 0.01$, * $p < 0.05$)

Except for the observational period from 21 November 2013 to 18 February 2014, the shaded path selection of female was significantly higher than that of male. This analytical result implies females are more sensitive to protect the skin from the UV rays than males except winter months rather than thermal discomfort.

2014. The use of the overpass increased in summer months, and decreased in winter months.

selection was decreased to around 50% by the end of December and was increased again from the end of March.

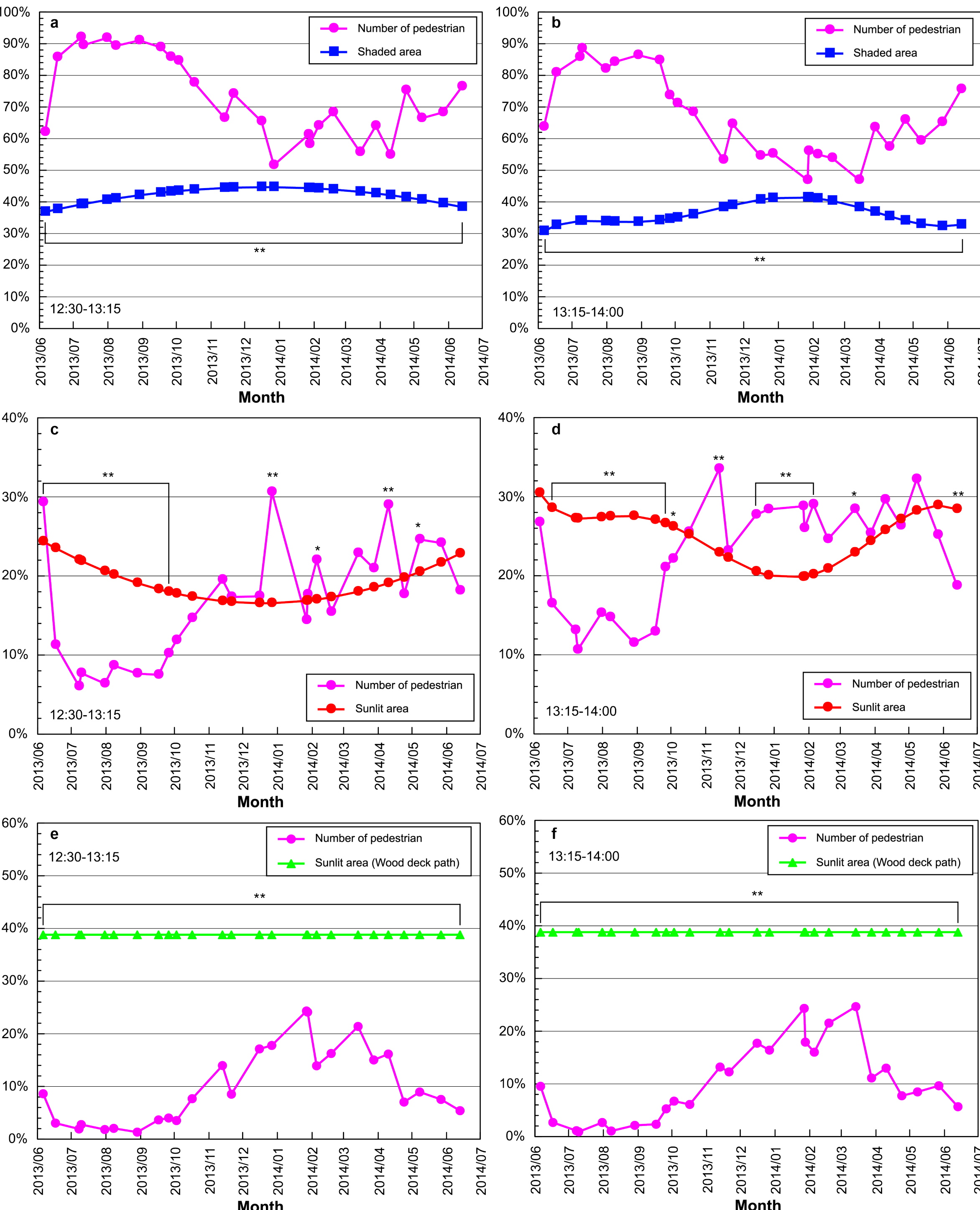


Fig. 6 Percentage of each path selection by the pedestrians in comparison with each path area. (** $p < 0.01$, * $p < 0.05$)

Almost all pedestrians probably prefer to walk on shaded pass to reduce thermal discomfort and/or protect the skin from the UV rays from the end of spring till the beginning of autumn (Fig. 6 a, Fig. 6 b). Although pedestrians consciously select sunlit path on occasion in autumn and winter months, there is no definite cause to walk on sunlit path at this time (Fig. 6 c, Fig. 6 d). The percentage of pedestrian selected sunlit path covered with wood (wood deck path) was significantly lower than that of sunlit path area through a whole year (Fig. 6 e, Fig. 6 f). Benches and plants on the wood deck as seen in Figure 2 may interfere with walking on sunlit path covered with wood.

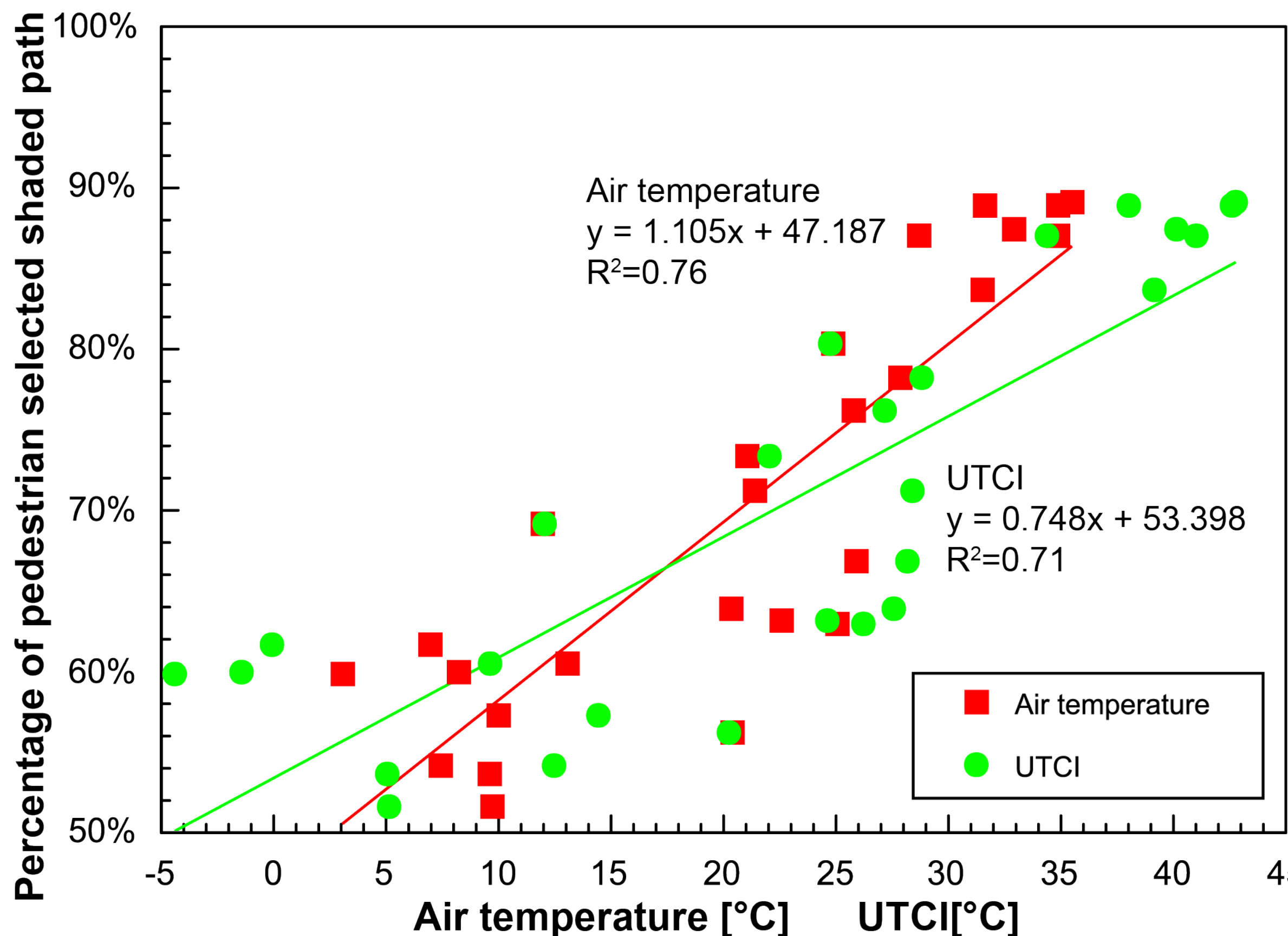


Fig. 7 Percentage of pedestrian selected shaded path in relation to air temperature and UTCI.

Air temperature is the strongest thermal factor whether pedestrians walk on shaded path or not on a clear day. The regression line indicates over 80% pedestrians walk on shaded path, when air temperature exceeds about 30 °C. In terms of the slope of the regression line, per about 10 °C rise in air temperature increases 10% of pedestrians' selection of shaded path.