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Improving ice quality for performance and sustainability

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The physics of ice rinks

Ice skating is an integral part of Dutch culture, from recreational skaters on frozen canals to Olympic athletes pushing the limits of speed and precision. Maintaining high-quality ice, however, is a blend of art and science. The hands-on experience of the “ice masters” at Thialf has ensured a world-class ice rink for both Short Track and Speed Skating disciplines over the last decades. However, this expertise needs to be supported by scientific understanding. Such insights could, in turn, improve ice performance, sustainability, and energy efficiency.

Measurability of Ice Quality

Objectively quantifying the quality of ice rinks is the first challenge. Figure 1 illustrates the relationship between key variables that will be investigated in this study. Subjective terms like grip and glide are commonly used by elite skaters and ice masters to describe ice quality. On the material science side, bulk ice and ice surfaces have been extensively researched under laboratory conditions[1,2]. However, these findings do not translate well to the practical setting of the ice rink[3,4,5]. Therefore, robust tools are needed to measure ice quality effectively in real-world conditions.

The second challenge is understanding the variability of ice quality. Ice properties can differ depending on factors such as water composition, environmental conditions in the rink, and the specific needs of each skating discipline. By developing tools to analyze the relationship between the ice’s frictional properties and external variables this understanding can be tested and refined through experiments that simulate realistic rink conditions.

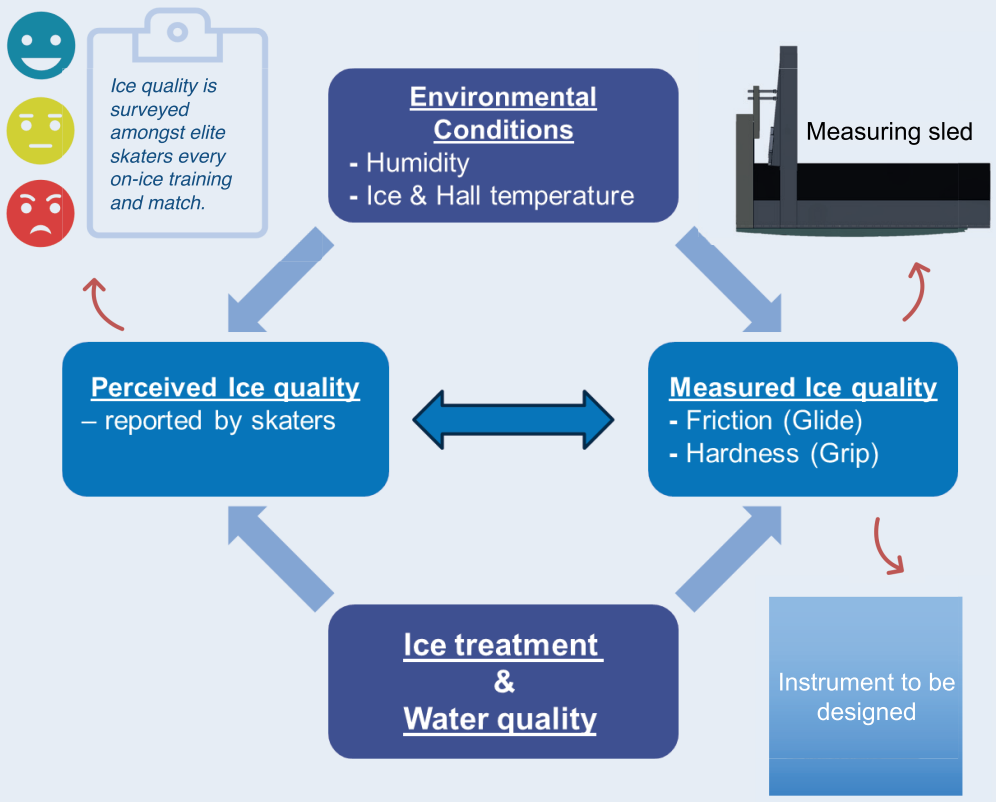

Fig 1. Schemetic represetation of important relationships between variables that have to be researched and trough what means they are studied.

Research goals

The project’s first goal is to develop both objective and subjective measurement techniques for ice quality. This goal will be achieved by combining research tools in the lab, alongside real-world tests at Thialf on the ice rink (see Fig. 2), and combining these with perceived ice quality of the skaters. Over four years, this project aims to establish clear metrics that will allow ice quality to be fine-tuned for different skating disciplines, enhancing both performance and sustainability. The ultimate goal is to create an adaptable system for ice maintenance that improves athletes’ performance while reducing energy consumption.

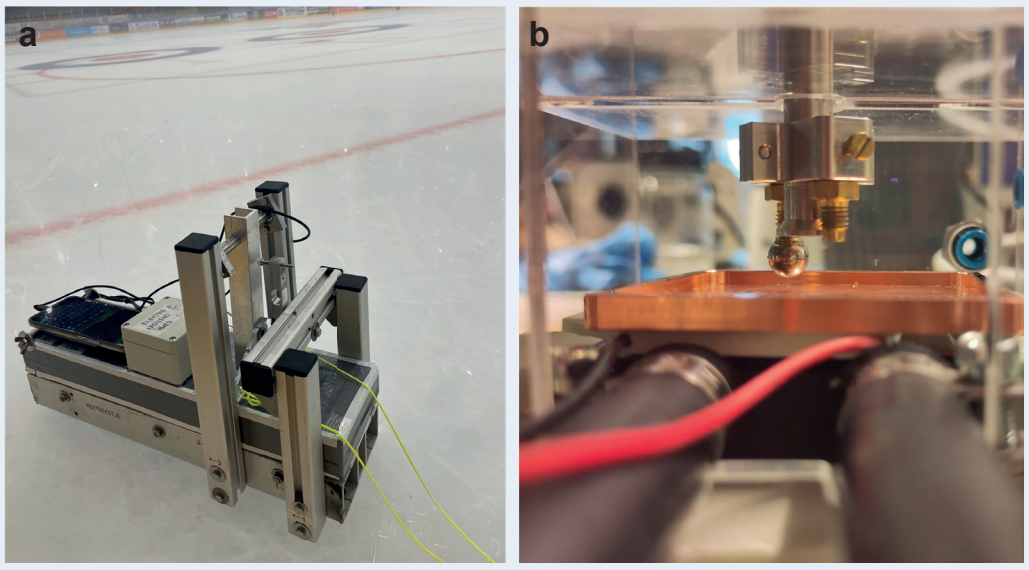

Fig 2. Measuring friction on an ice rink with use of a friction sled (a) and measuring friction in a lab setting with a rheometer (b).

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