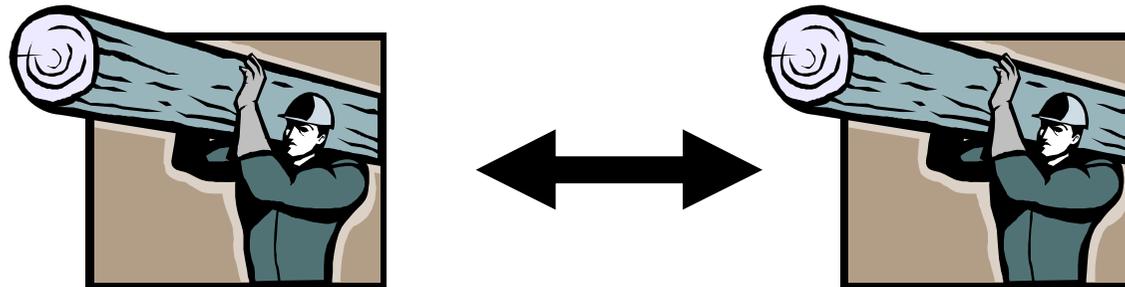


Developing and Validating the Automatic Log Transfer Mechanism between Two Carriages



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Background

- Ground harvesting systems achieved the higher productivity than ever before by introducing up-to-date forestry machines such as harvesters or harwarders.
- On the other hand, cable harvesting systems used on steep slopes have not been greatly improved since 1995 when the combined tower yarder and processor head was introduced by Koller GmbH.

Harwarder

Two-machine system



Harwarder system





Ponsse Buffalo Dual



MM FORSTTECHNIK: <http://www.mm-forsttechnik.at/syncrofalke/1003.php>

What is the next innovation?



Syncrofalke

Purpose

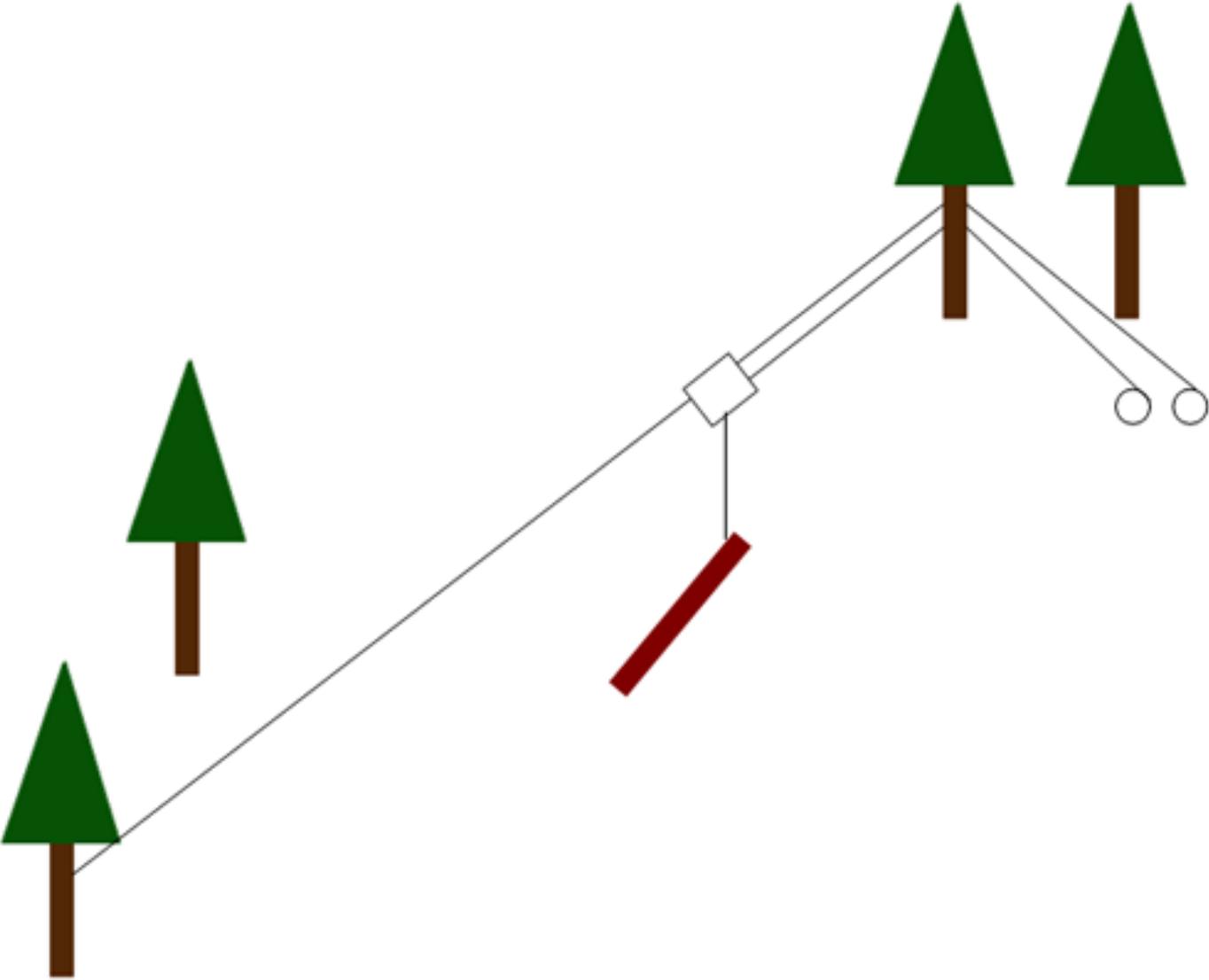
The objective of this study is to validate the new cable harvesting systems with the log transfer mechanism by:

- 1.making a test model of it, conducting the feasibility assessment,
- 2.estimated the productivity using system dynamics simulation,
- 3.comparing the productivity of it with that of the other cable harvesting systems

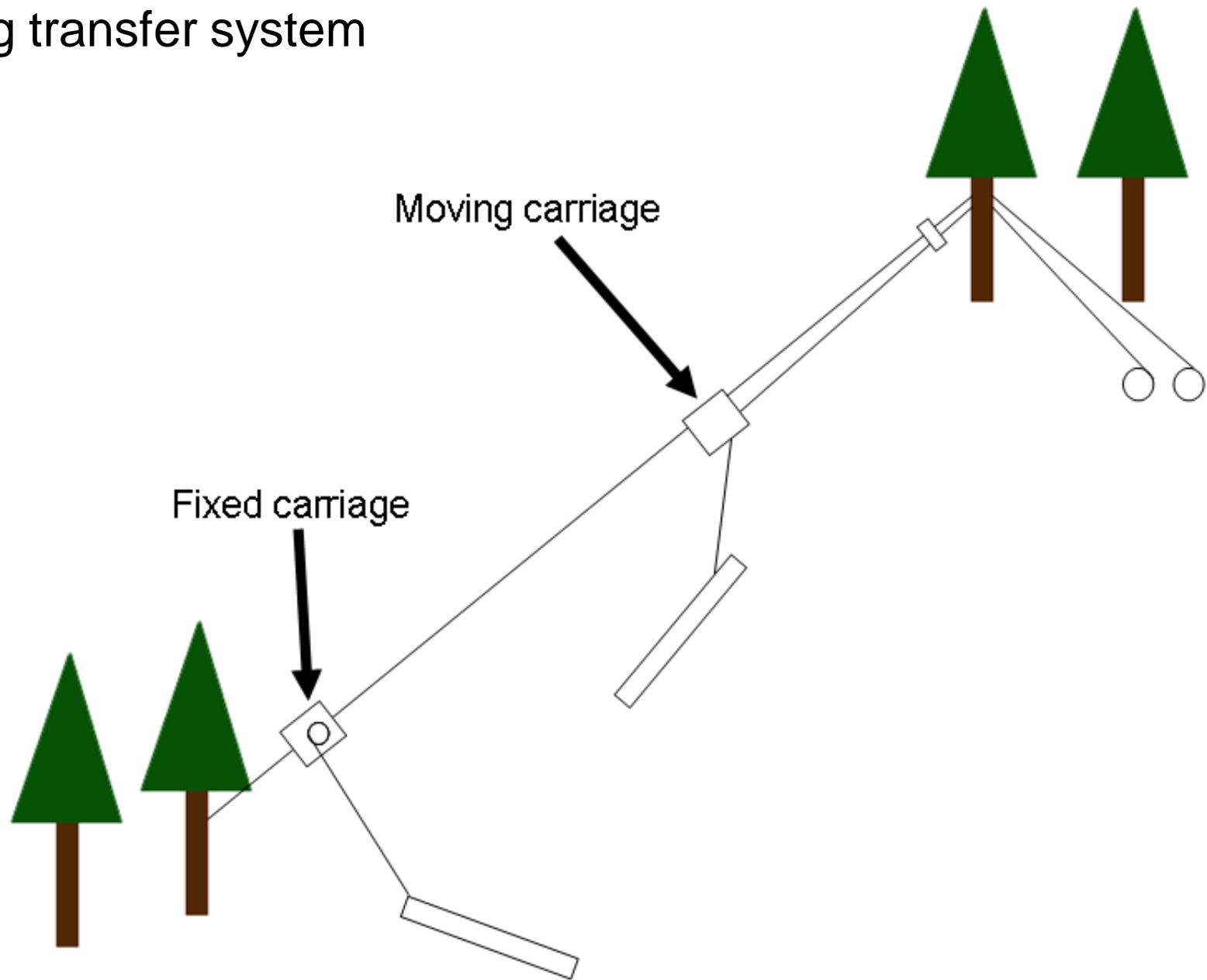
Productivity comparison

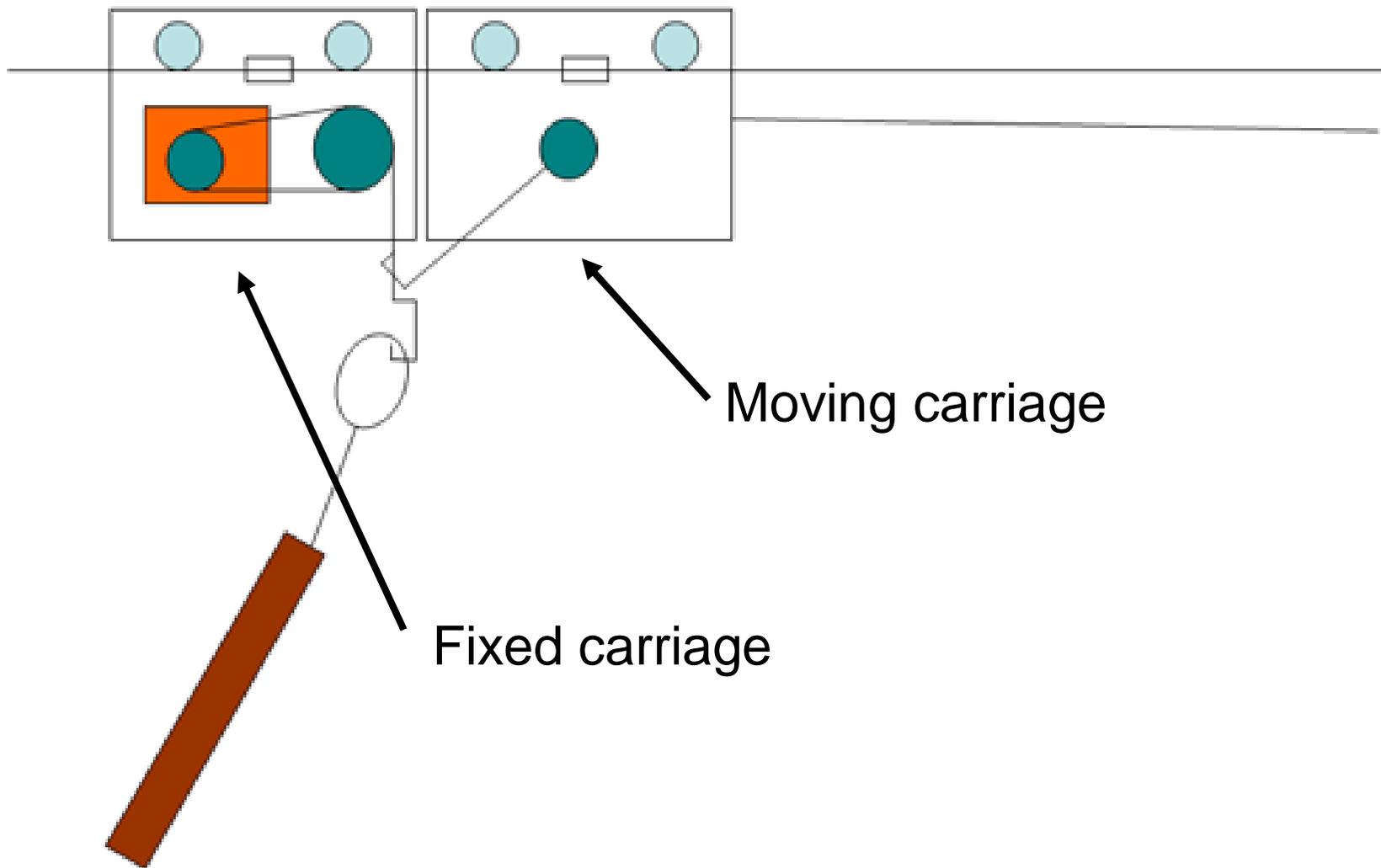
- Gravity system
- Log transfer system
- Ground transfer system
- Log exchange system
- Third-stage system

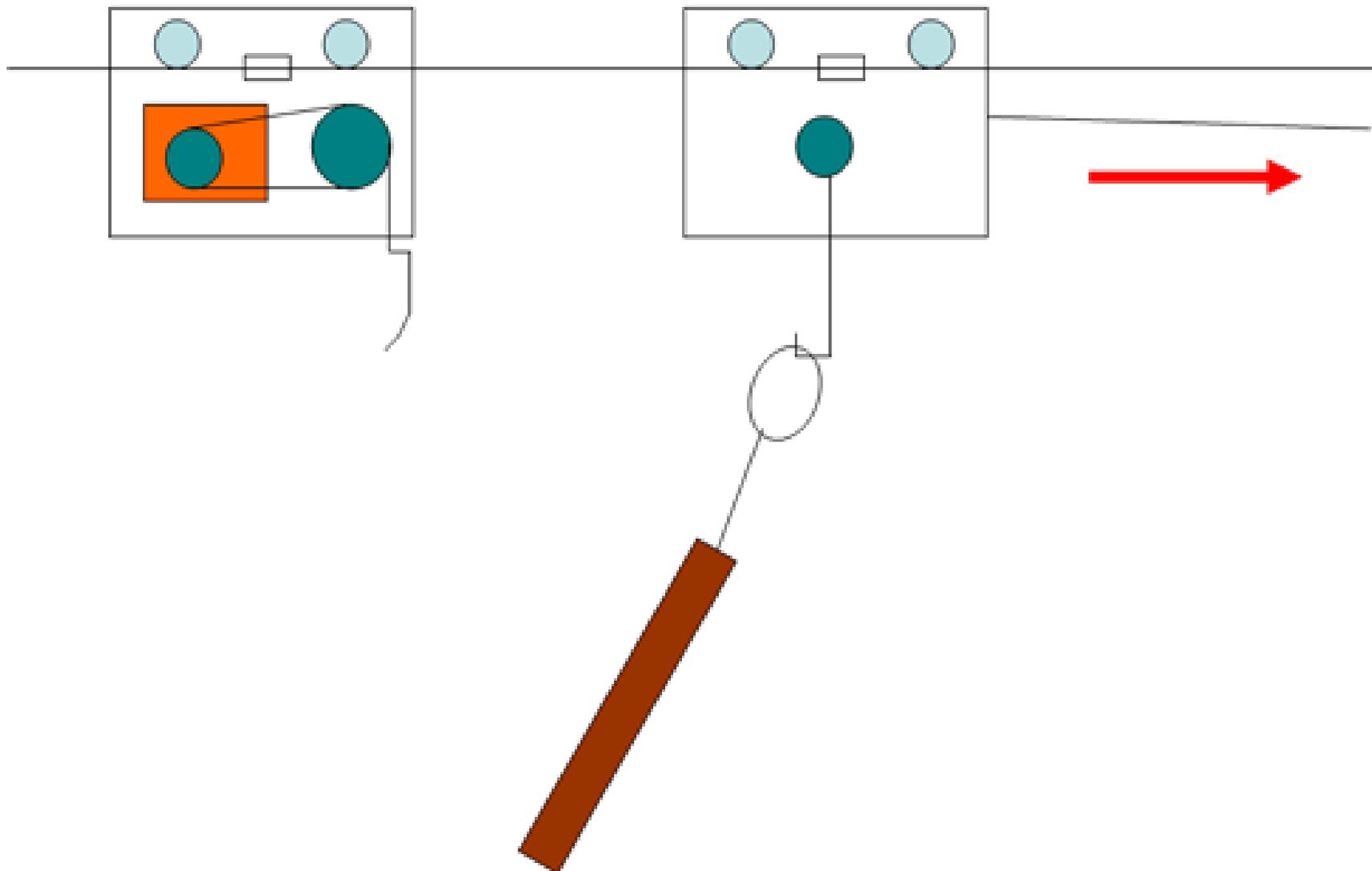
Gravity system



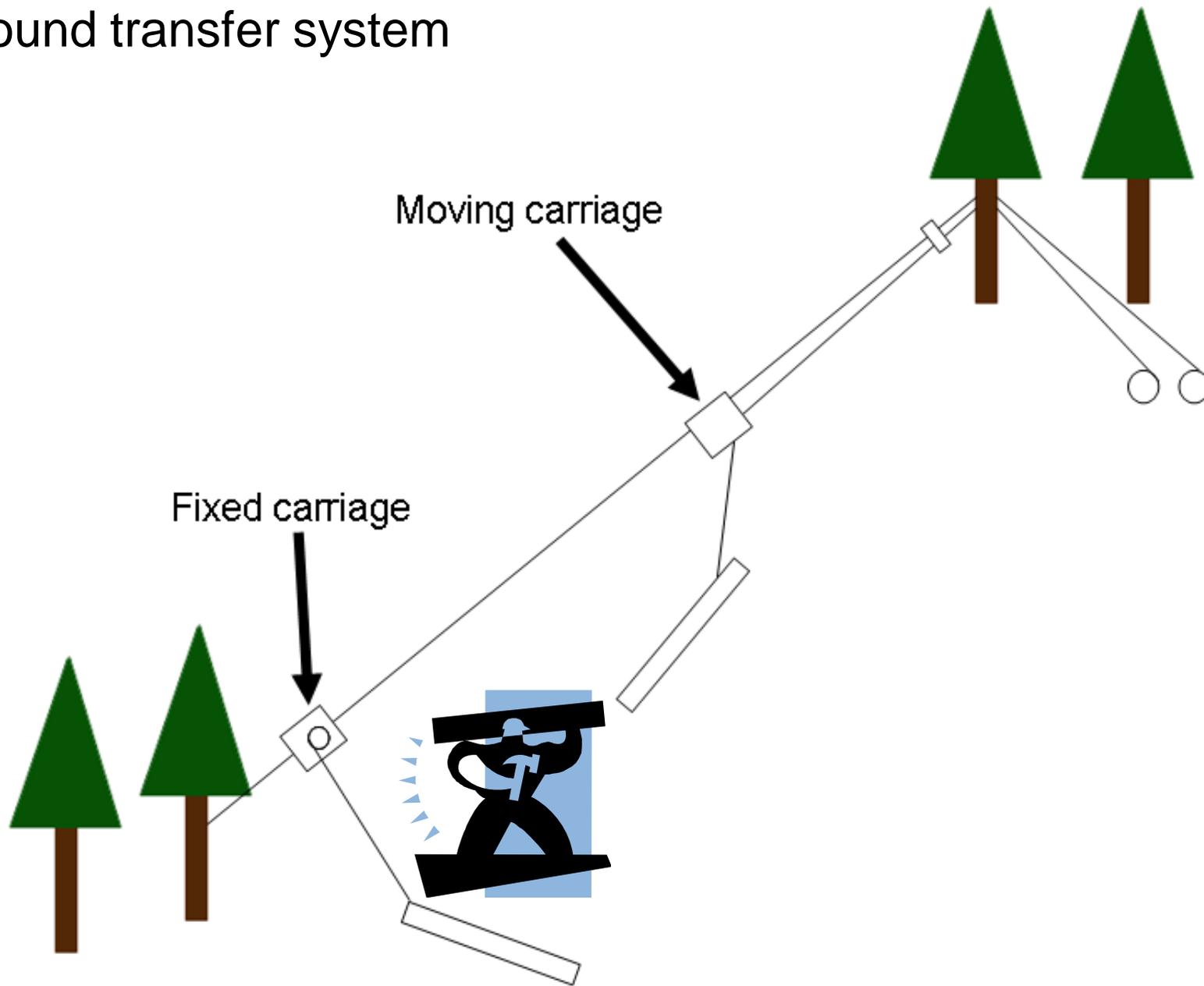
Log transfer system



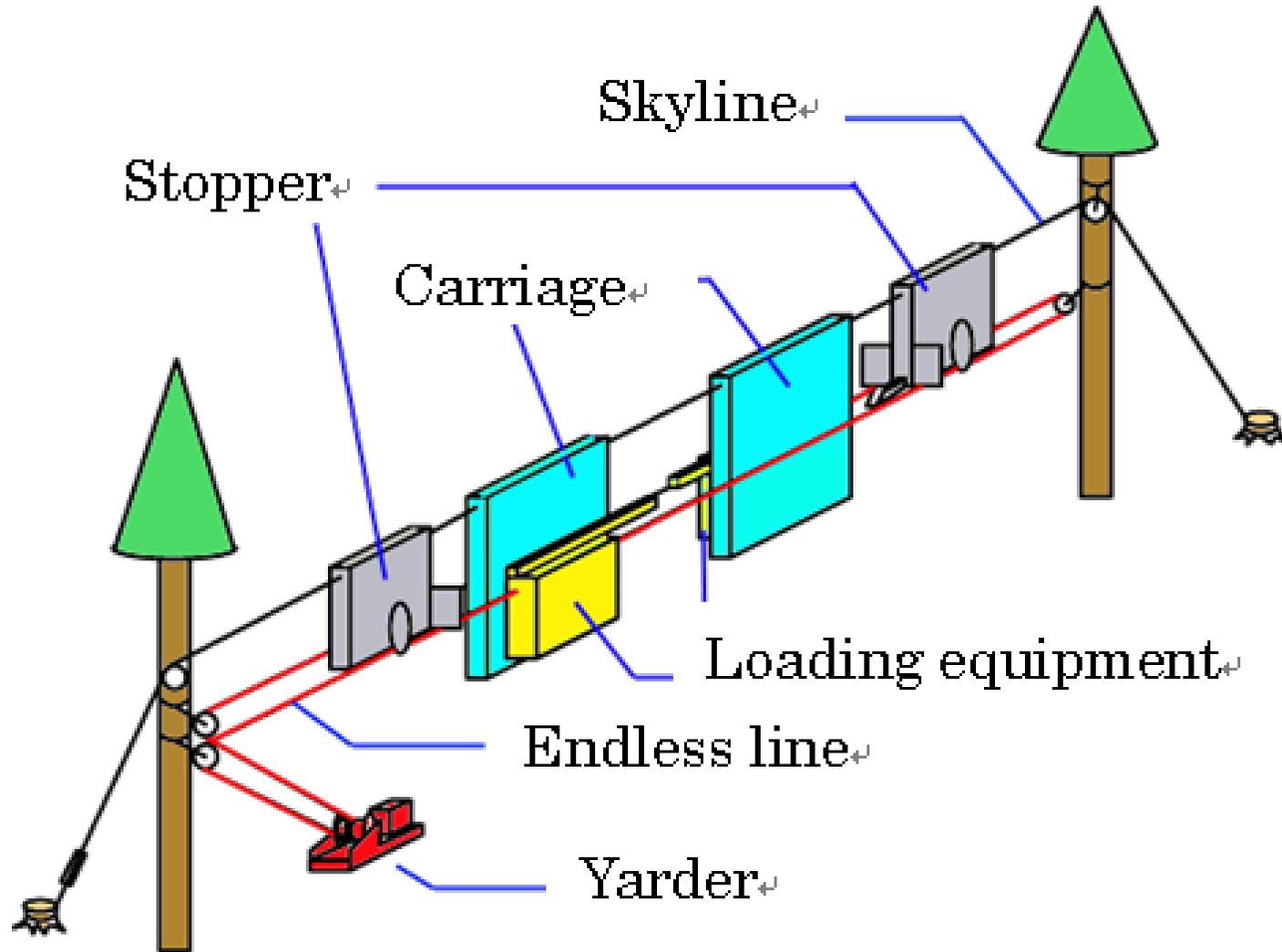




Ground transfer system

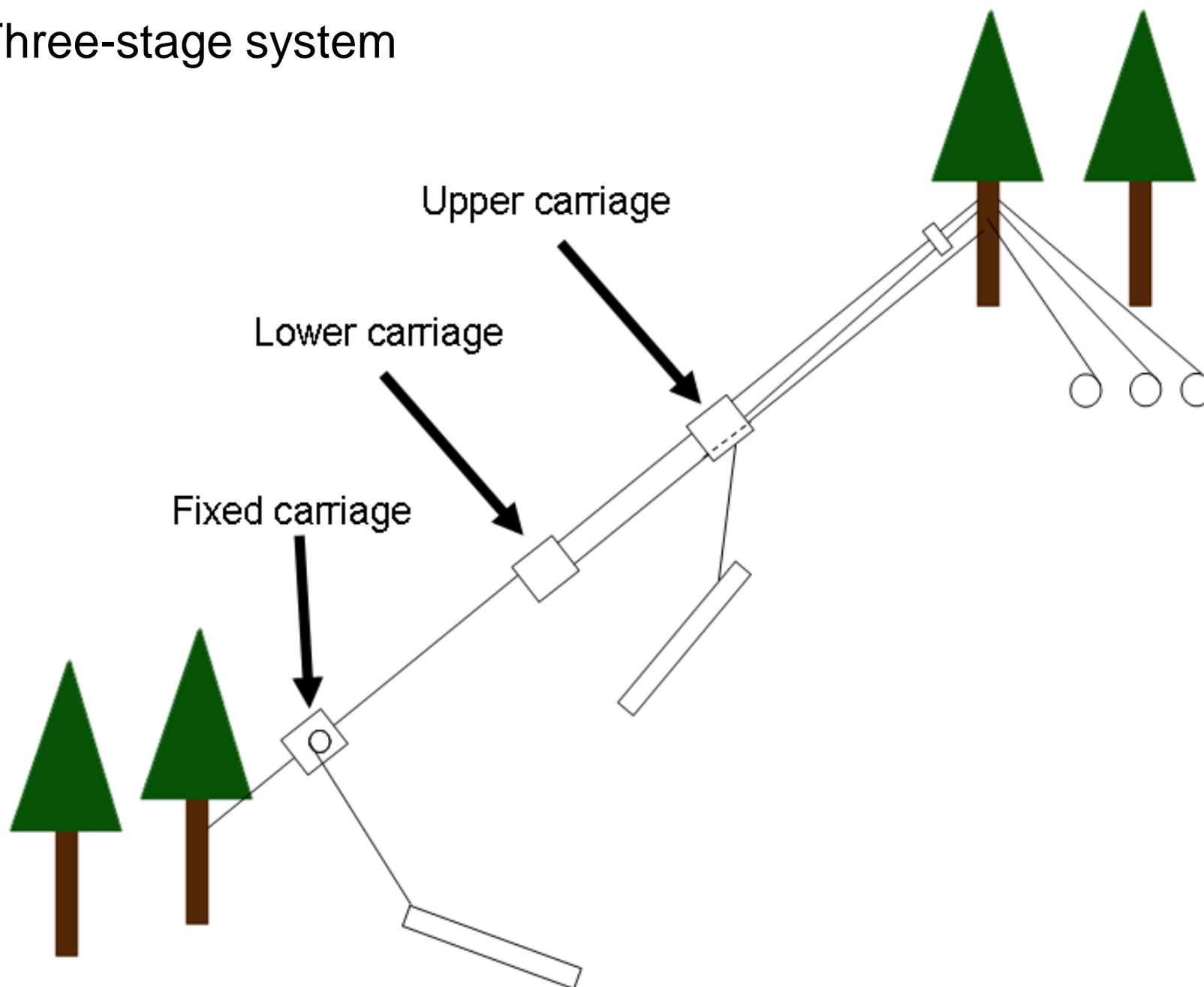


Log exchange system developed by Aruga et al.



Aruga, K., Tasaka, T., Nishikawa, A., and Yamasaki, T. (2009) Development of a new operation system with carriages for turn back yarding system. Proceedings, Environmentally Sound Forest Operations 32nd Annual Meeting of the Council on Forest Engineering: CD-ROM, 2009

Three-stage system



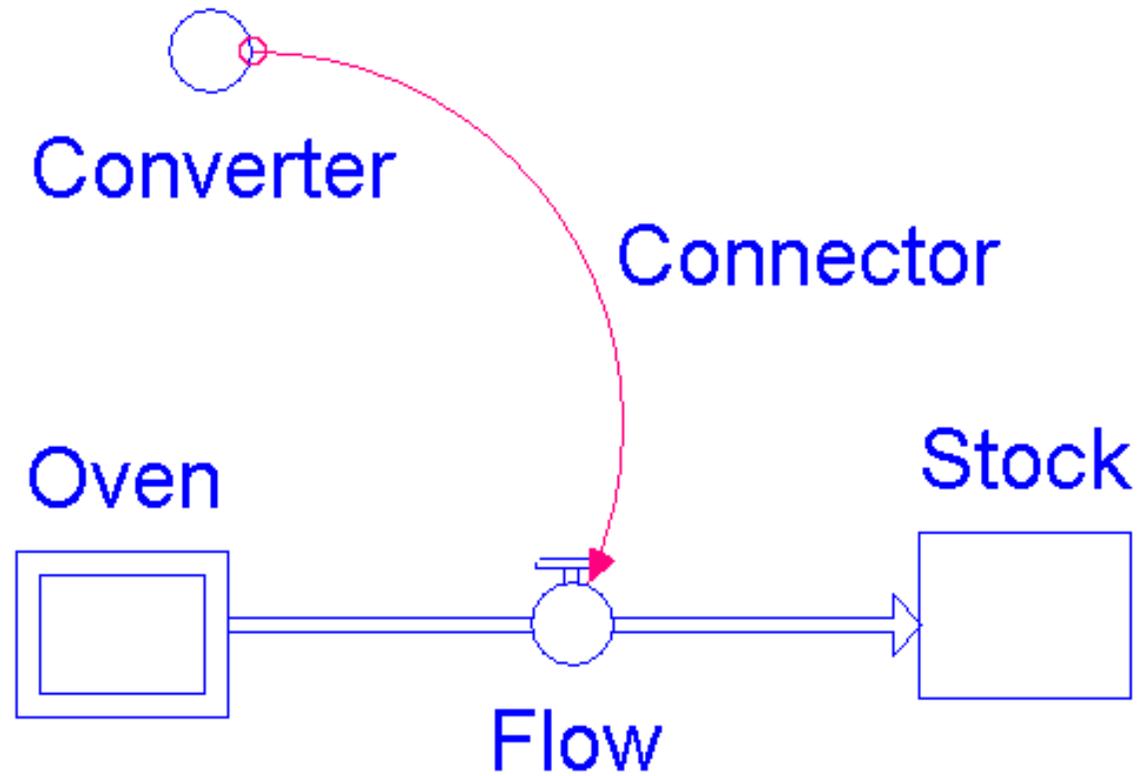
Simulation

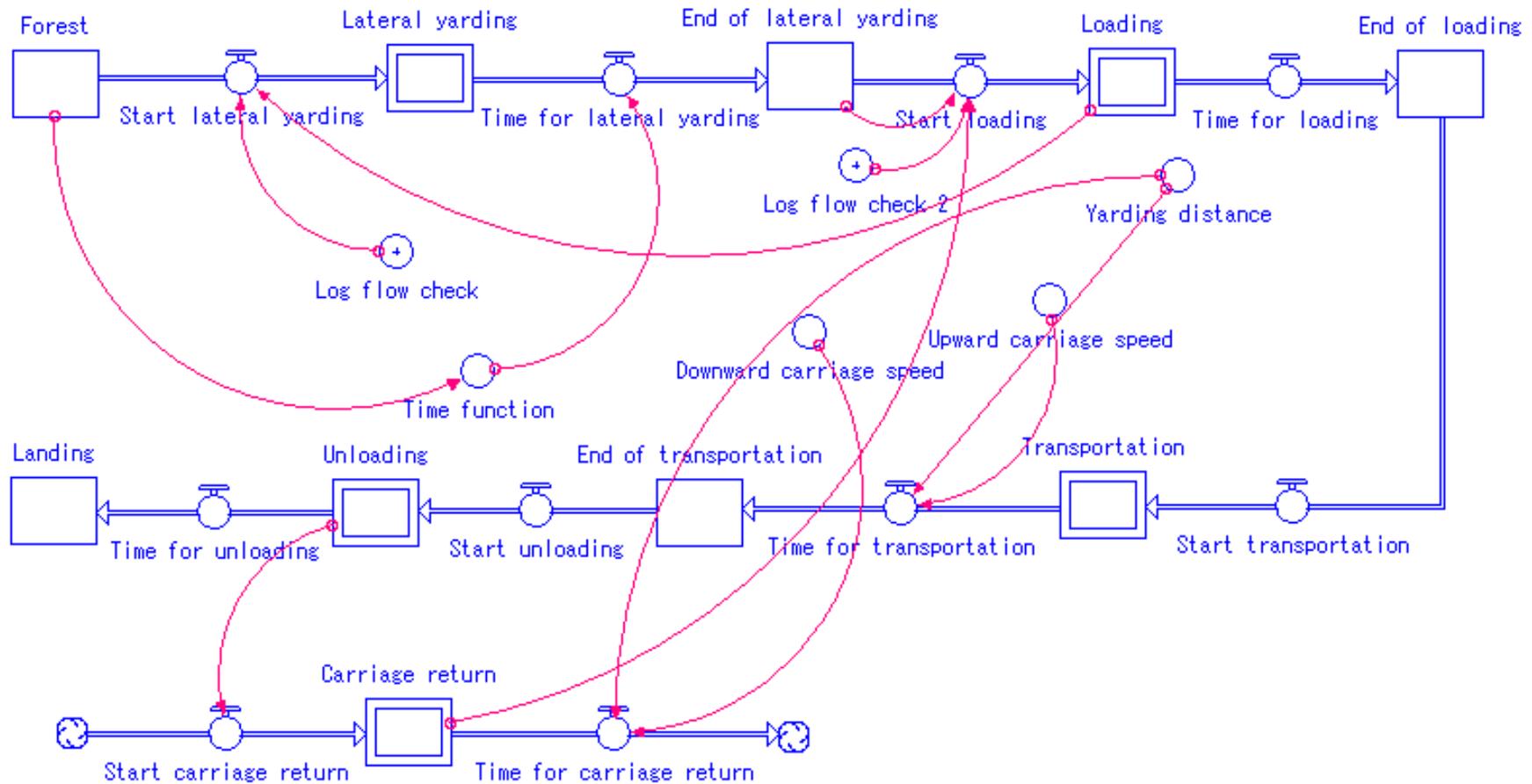
- We evaluated the new cable harvesting system in terms of productivity by using system dynamics simulation, which helps us understand the behavior of complex systems over time.
- We used STELLA 9.1.3 (isee systems), which is a visual diagram-based simulation application program for system dynamics models, to model the new concepts of cable harvesting systems.

Advantages of using system dynamics simulation

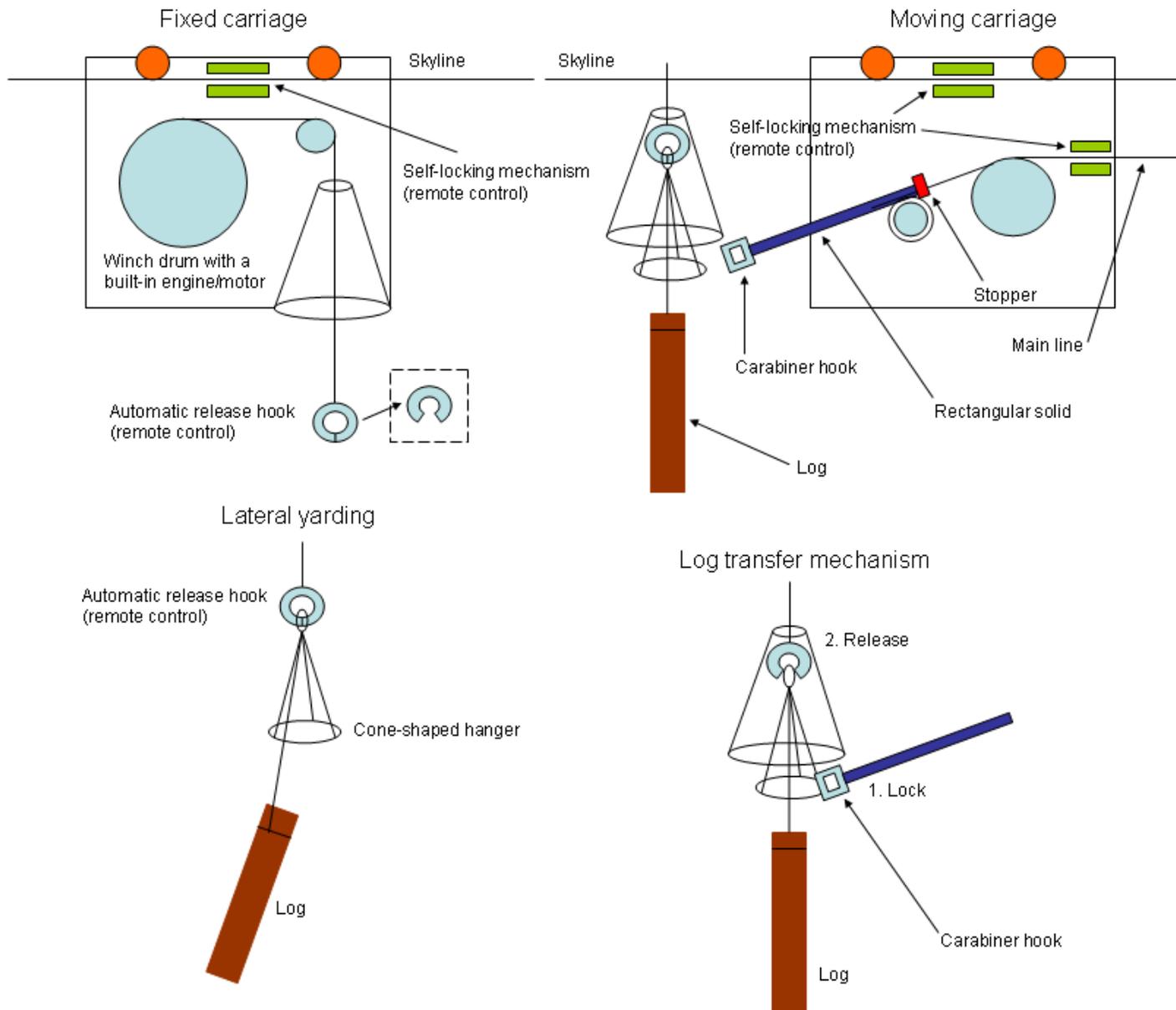
- ❑ Flexible and customizable to better fit the actual conditions
- ❑ High compatibility, interchangeability, understandability and simplicity of models

Components used in STELLA

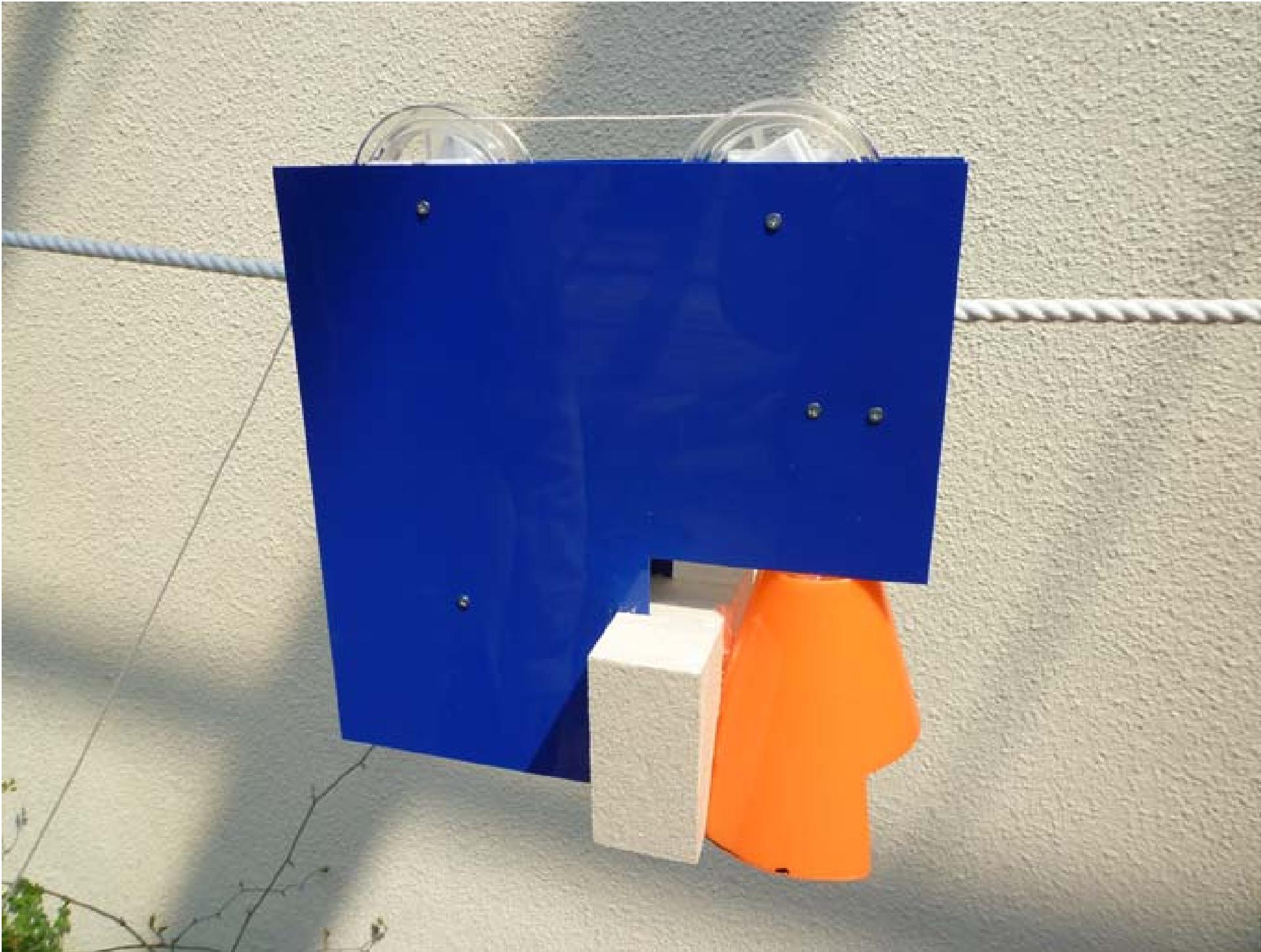


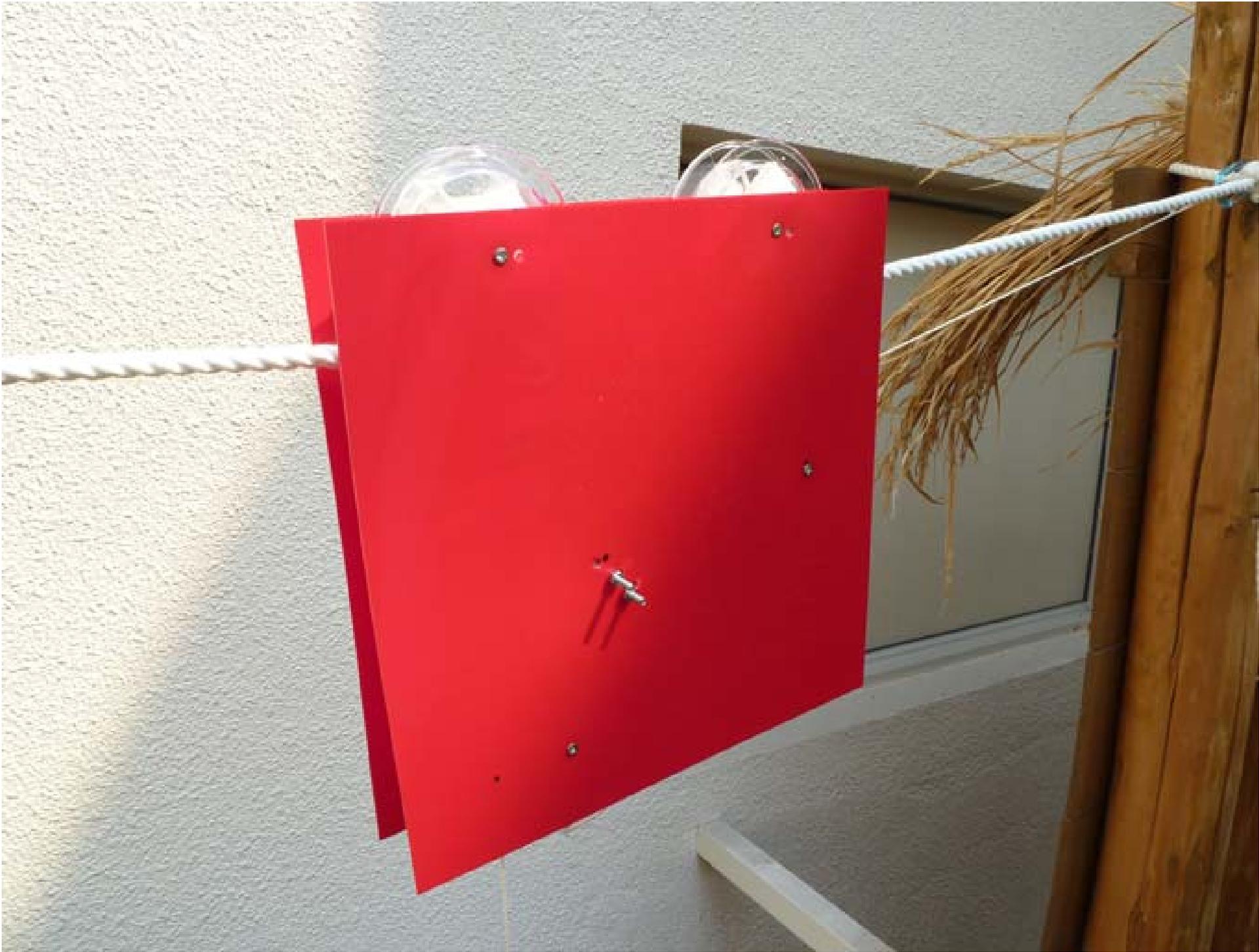


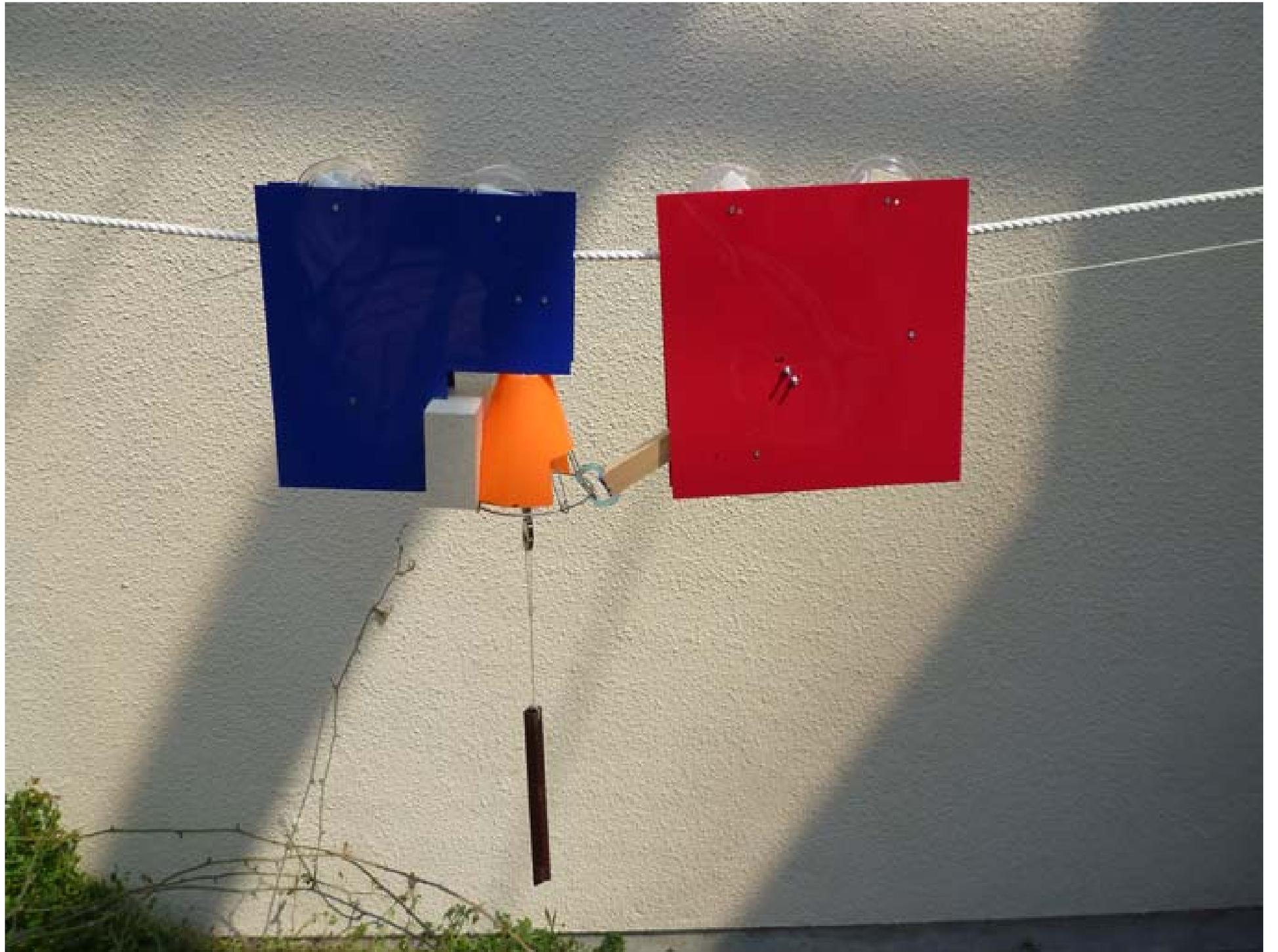
Simulation model of the log transfer system

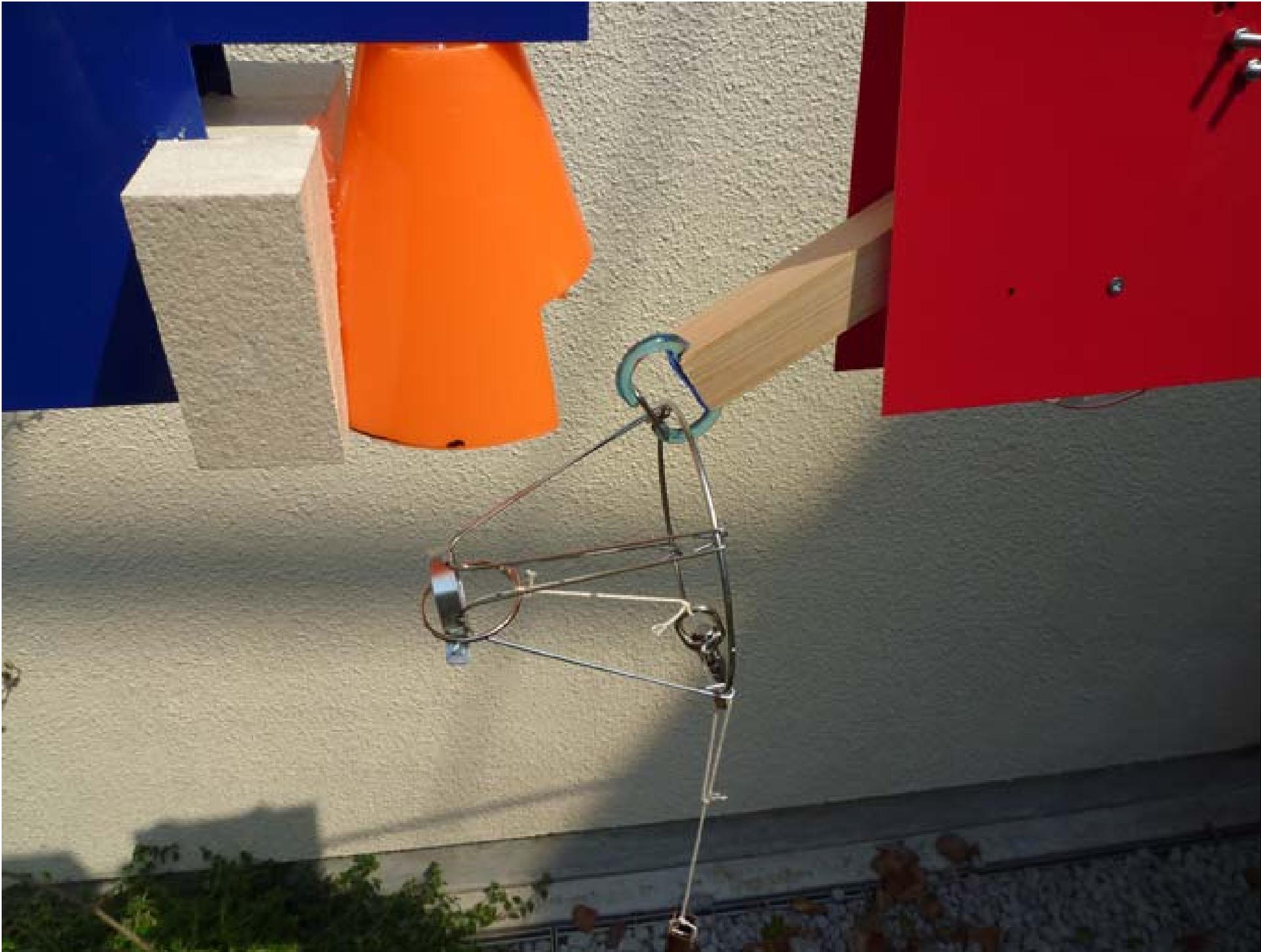


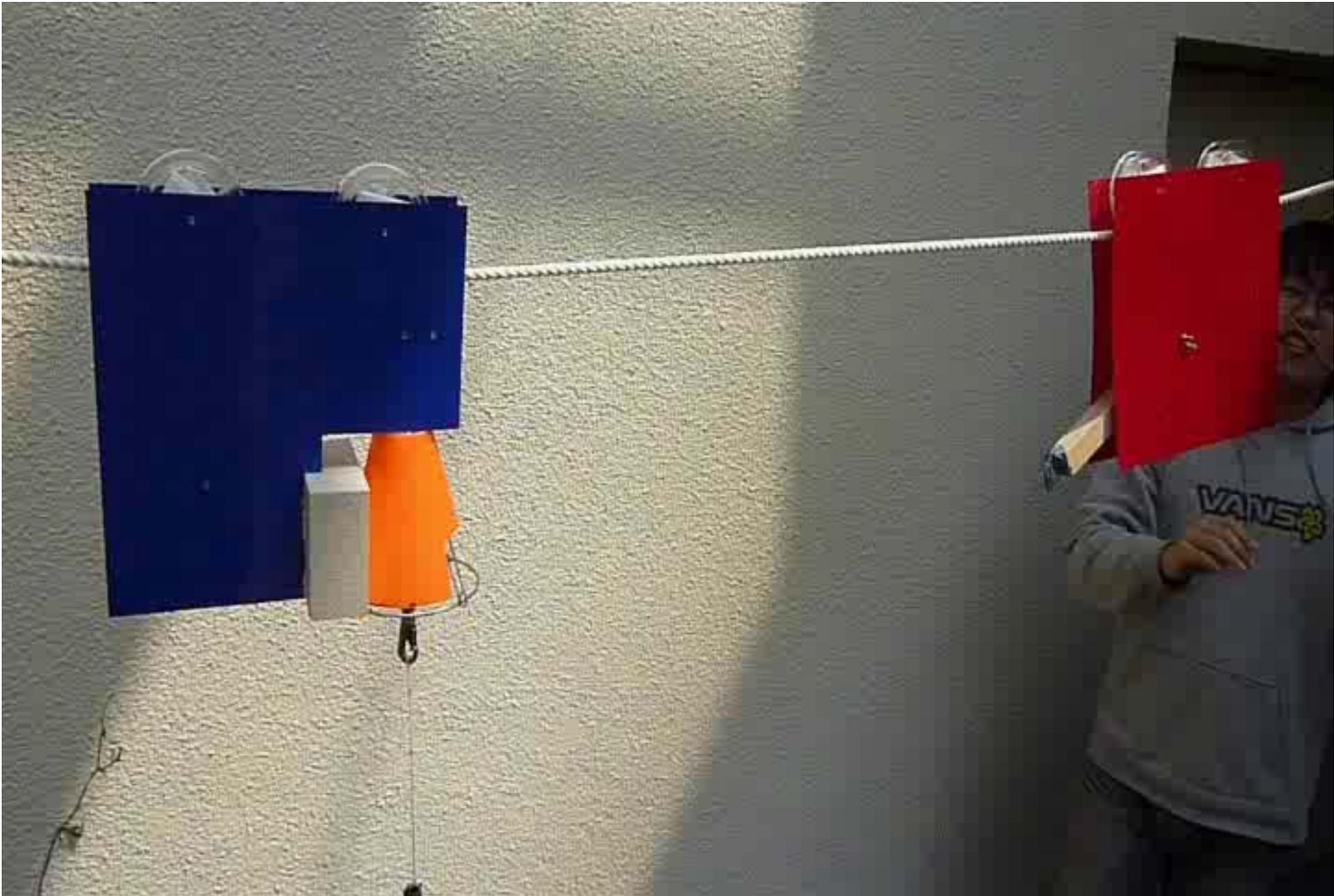
Log transfer mechanism between the fixed carriage and moving one

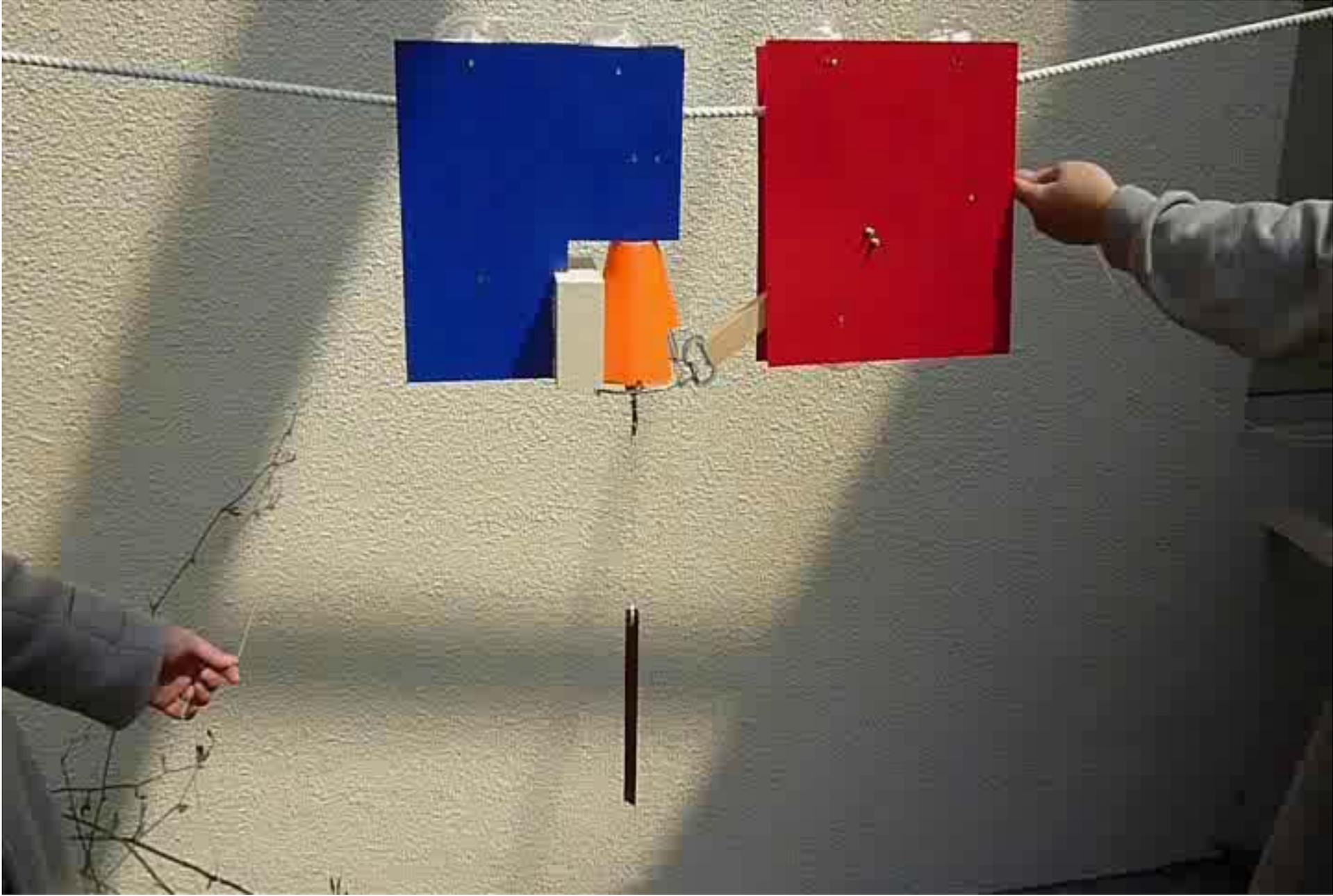


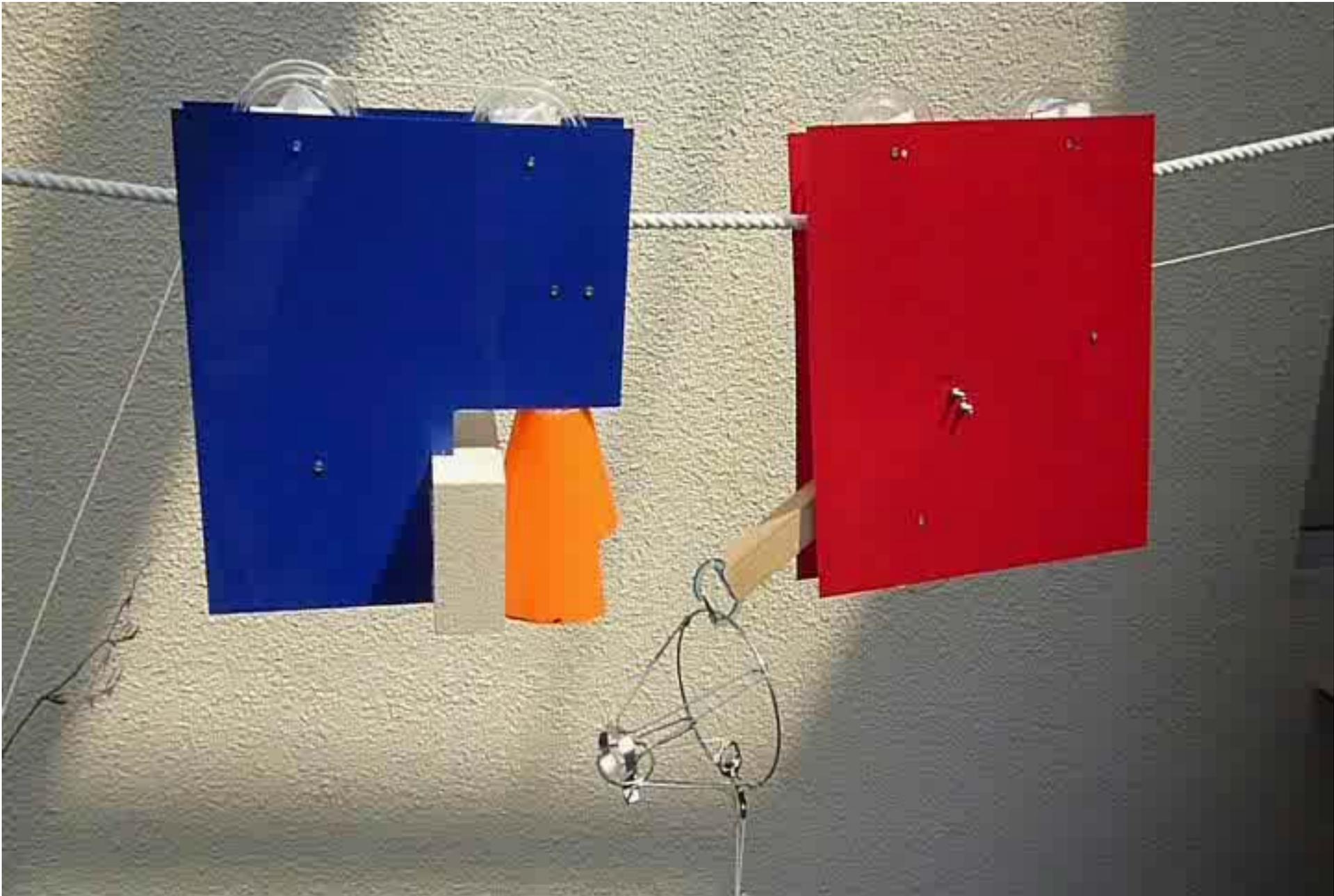


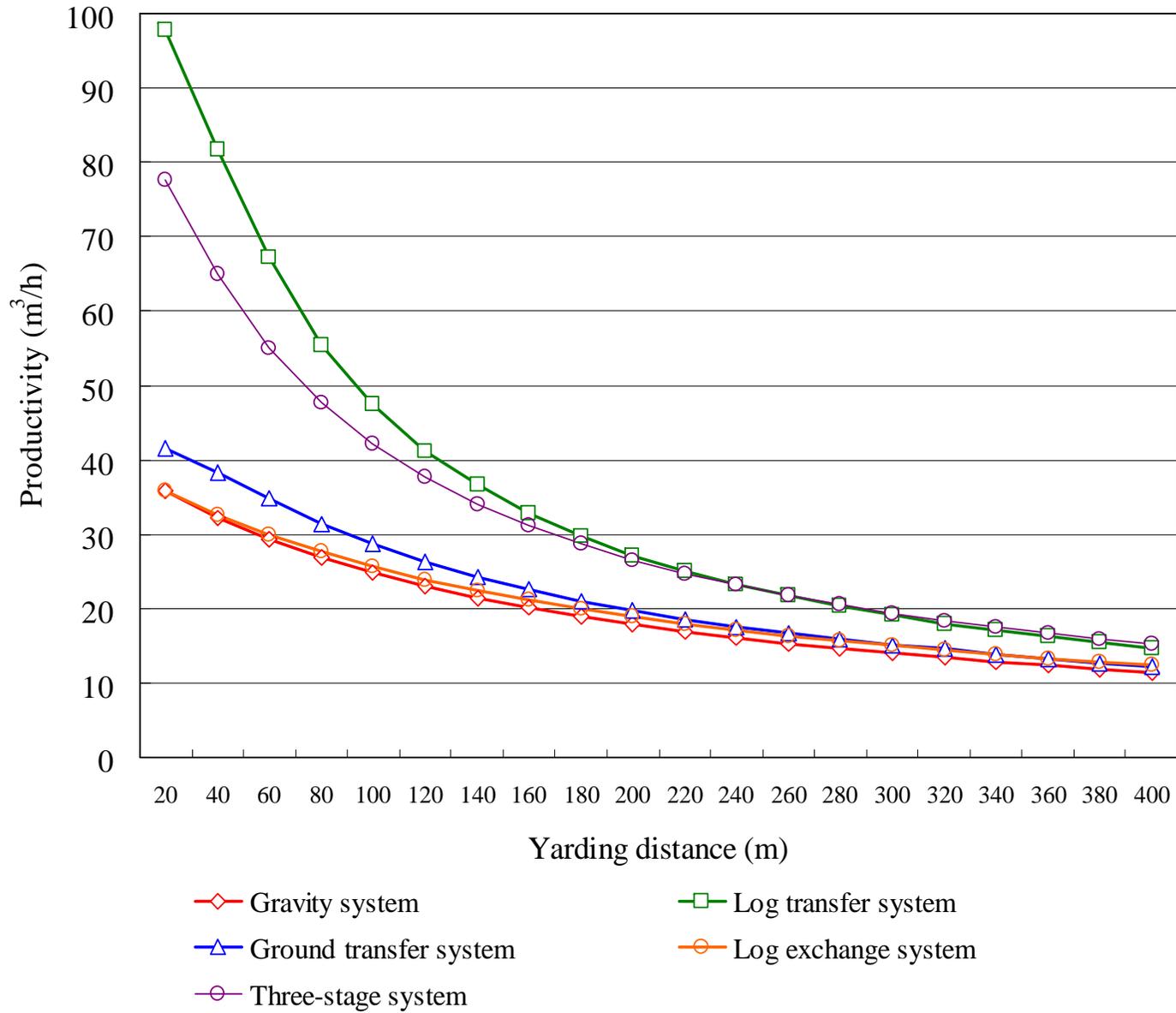








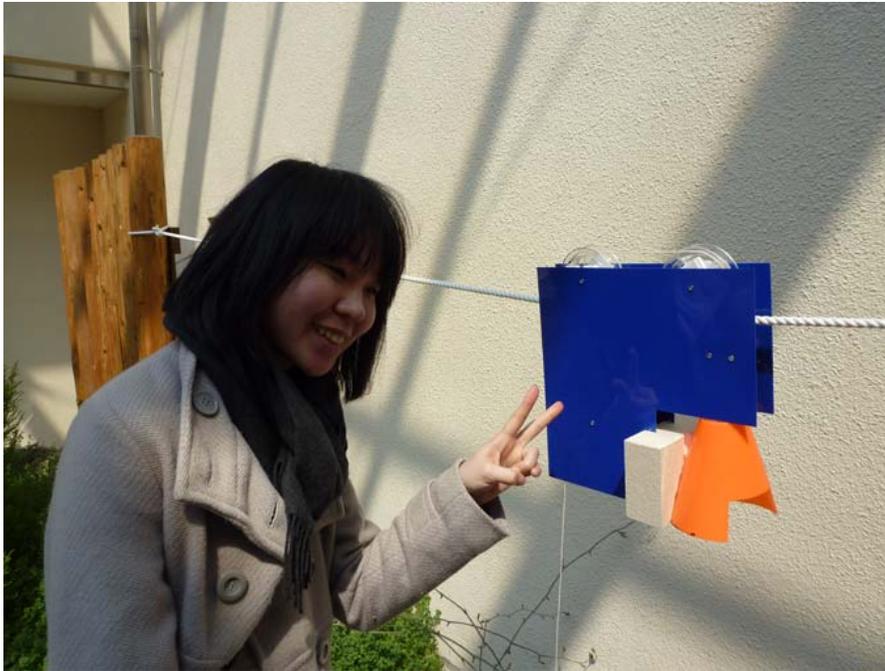




Productivity variation according to the yarding distance

Conclusions

- The log transfer/three-stage systems proposed in this study had higher productivity than the other three systems, that is, gravity system, ground transfer system and log exchange system.
- The issues and improvements of the log transfer mechanism were identified by developing the test model: Two carriages should be more closely and tightly interlocked before the cone-shaped hanger is released by the automatic release hook.



Thank you for your attention.