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BIONICOHAND an opensource and collaborative myoelectric hand prothesis

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► To cite this version:

Nicolas Huchet, Côme Butin, Henri Boutard, Christophe Braillon, Yann Corbel, et al.. BIONICOHAND an opensource and collaborative myoelectric hand prothesis. IFESS 2025 - 28th Annual Conference of the International Functional Electrical Stimulation Society, May 2025, Chicago, United States. 2025. <hal-05285381>

HAL Id: hal-05285381

<https://inria.hal.science/hal-05285381v1>

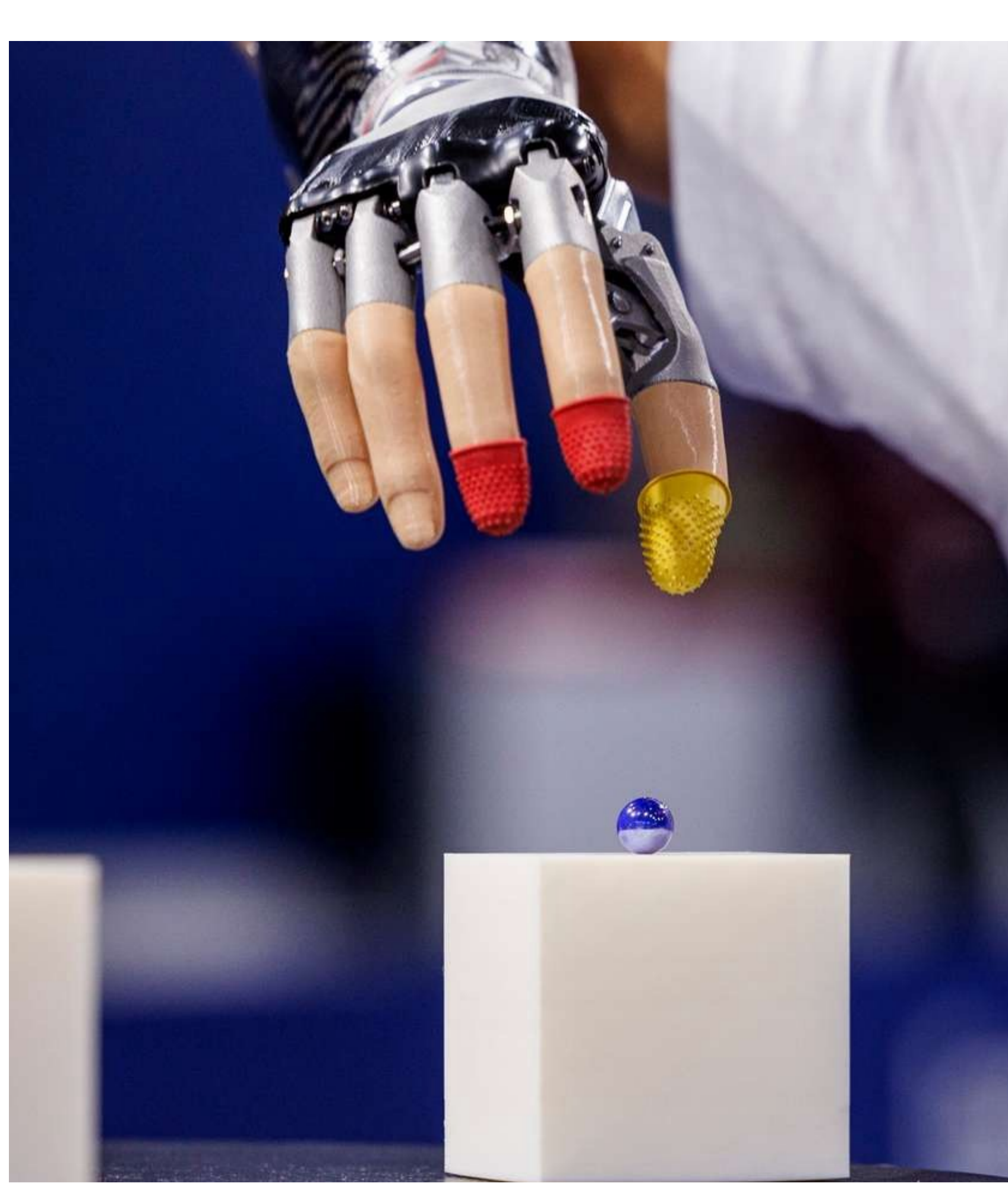
Submitted on 26 Sep 2025

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BIONICOHAND

an OPENSOURCE and COLLABORATIVE MYOELECTRIC HAND PROSTHESIS

MHK
My Human Kit

Inria



RÉPUBLIQUE
FRANÇAISE

Liberté
Égalité
Fraternité

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<https://bionico.org>

CONTEXT

Bionicohand (BNH) is a myoelectric prosthesis designed and developed by a community-driven multidisciplinary network formed around an individual with a hand amputation, aiming to closely meet his needs while making technical choices that will eventually make it accessible and acceptable. The features of this open-source hand, as well as its performances, are presented.

METHODS

A single motor activates two grips depending on the thumb positioning (opposition vs lateral). Two electromyographic (EMG) sensors allow control of the hand's opening and closing. BNH is equipped with a universal wrist designed to be used with various tools (knife, screwdriver...). 1 participant with a transradial amputation performed a series of evaluation tests (SHAP test, dynamometry) to compare BNH with his commercial prosthetics (Michelangelo, Ottobock). 2 dynamometers were used for pinch and grip evaluation using different grip sizes. During the 2024 Cybathlon held in Zurich, this hand participated in the ARM discipline events, which involved completing a series of 10 object manipulation tasks representative of real-life situations.

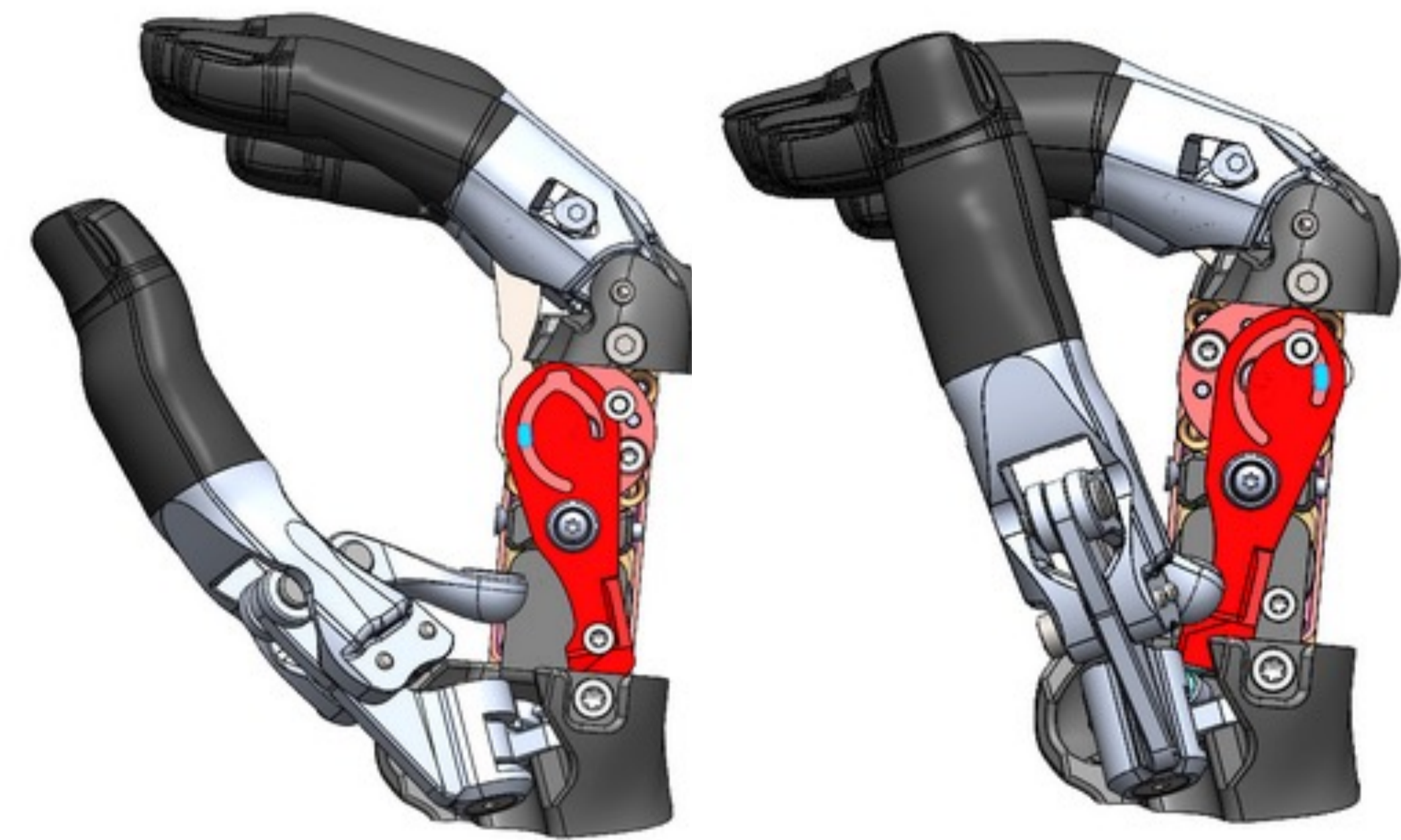


Figure 1: BNH 3D model presenting the 2 thumb positions (opposition and lateral)

RESULTS

Execution times to achieve the different tasks of the SHAP test [1] are presented (fig 2). The obtained LIF score [2] is 0,9 for the commercial prosthetics and 0,86 for the BNH prosthetics (1 being the score for a population with no impairment).

The BNH prosthetics was able to deliver a maximum force of 8,9Kg for the opposition position and 2,7kg for the lateral position. The commercial prosthetics was able to deliver a maximum force of 7,7Kg for the opposition position and 6,8kg for the lateral position.

The user equipped with the Bionicohand was able to complete 9 out of the 10 tasks, placing him second in CYBATHLON competition (Zurich, 2024). Execution times of the different tasks are presented (fig 3).

CONCLUSION

Designing high-performing assistive solutions tailored to individual needs, while anticipating their adaptability for a broader user base, is an innovative approach that achieves results nearing performance of commercial prosthetic devices.

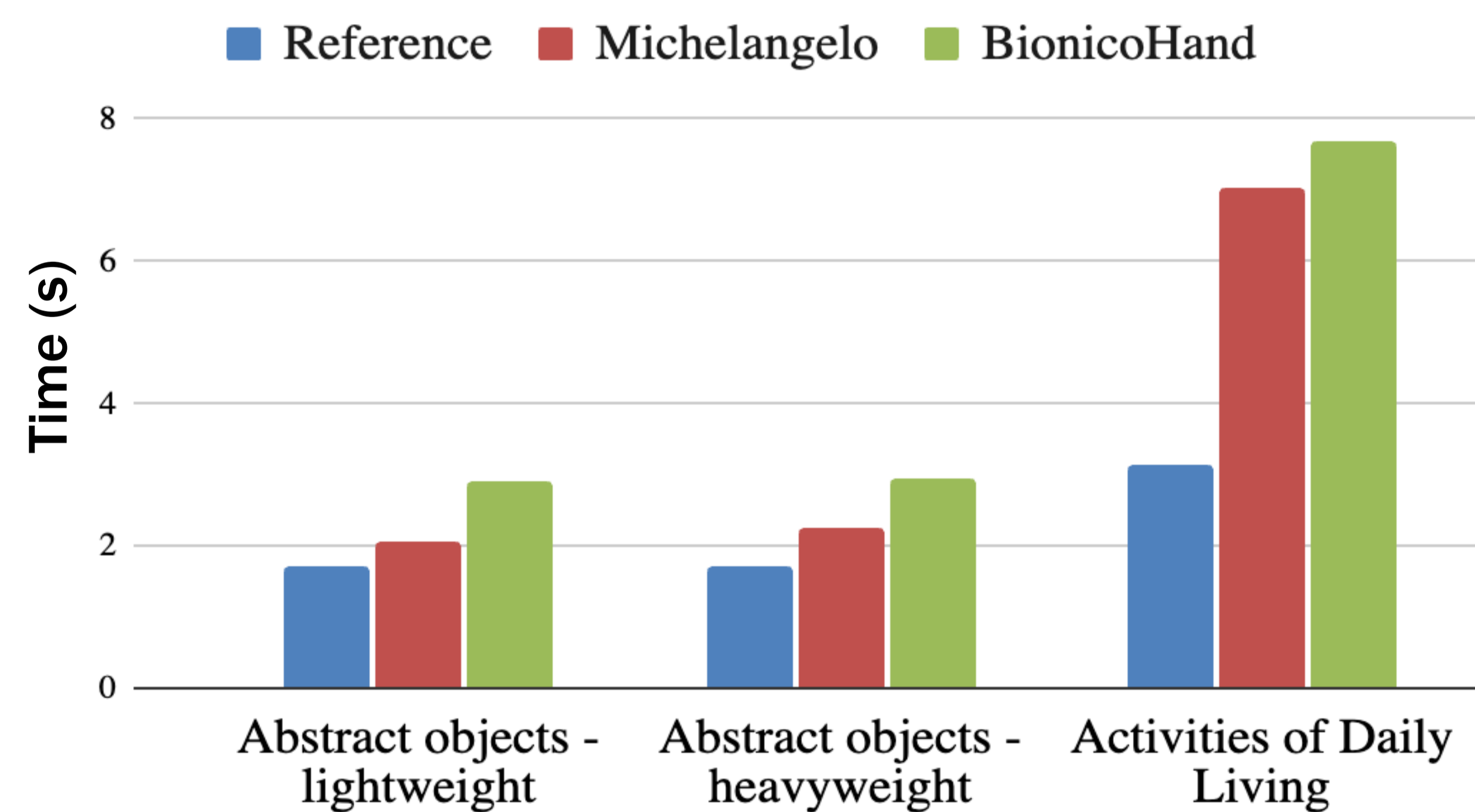


Figure 2: SHAP test tasks execution times for the two prosthetic hands compared to reference value.

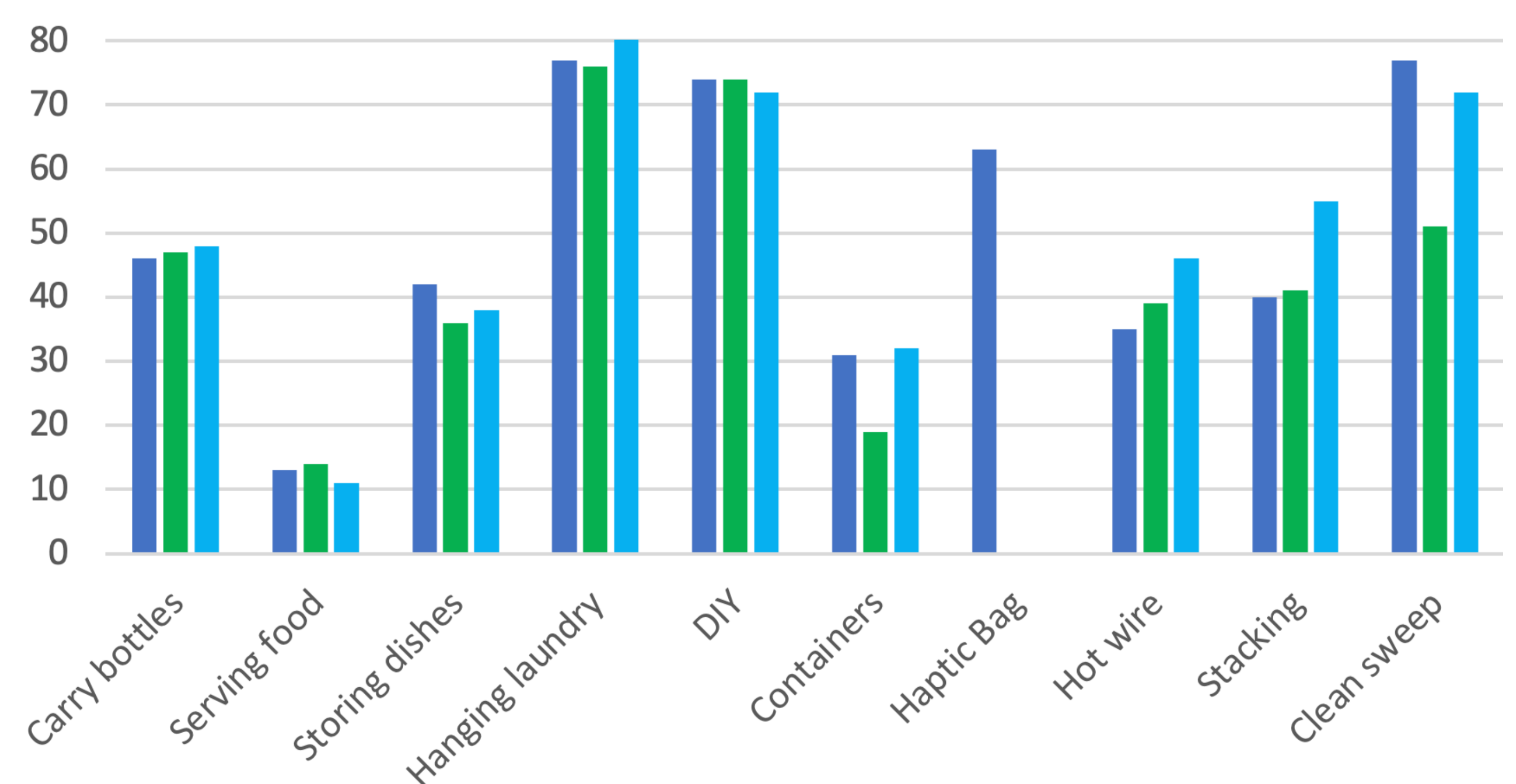


Figure 3: Cybathlon 10 tasks execution times (seconds) for the 3 first teams. 2nd bar (green) corresponds to BNH team. <https://cybathlon.com>

[1] Establishing a standardized clinical assessment tool of pathologic and prosthetic hand function: Normative data, reliability, and validity. C Light, P Chappel, P Kyberg. Archives of Physical Medicine and Rehabilitation 2002. DOI: [10.1053/apmr.2002.32737](https://doi.org/10.1053/apmr.2002.32737)

[2] The Southampton Hand Assessment Procedure revisited: A transparent linear scoring system, applied to data of experienced prosthetic users. J. Burgerhof, E Vasluiian, P Dijkstra, R Bongers, C Van der Sluis. Journal of Hand Therapy 2017. DOI: [10.1016/j.jht.2016.05.001](https://doi.org/10.1016/j.jht.2016.05.001)

