

# THE MOVEMENT REPORT

GENERATED BY  ARIONSTUDIO



**Why selecting the right shoes for your running style matters —  
and how ARION can help.**

## Welcome to the ARION Movement Report

At ARION, we are on a mission to decode human movement. After over a decade of research, years of operation, and thousands of hours of recorded movement data, one thing has become evident to us. Movement is exceptionally unique.

We have always had a passion for technology and the human body with a team of experts in Technology, Sports Sciences, and Biomechanics, including 4 PhD's and collaborations with leading institutes from across Europe such as, TNO (Dutch National Research Institute), Loughborough University, Luxembourg Institute of Health and Maastricht University. Built on more than 15 years of research heritage we have established a number of patents and a huge amount of knowledge related to human movement, particularly in the field of running and running-related injuries which would ultimately form the basis for our ARION innovations.

Our research shows that there can be no such thing as the one perfect style of running shoes. It all depends on your own unique biomechanics and your individual goals. The movement report aims not to simply judge generic shoe performance but to highlight the uniqueness of human movement and the array of potential benefits specific running shoes can bring to individual runners.

We all have our own body types, varied techniques, unique philosophies and personal goals. All of these elements heavily influence the way we move. Each contributes to our individual biomechanical profile into what we call, your unique running identity.

For this experiment, we tested the latest ASICS running shoes. We utilized our ground-breaking technology to demonstrate with data how running shoe models can have very diverse results for different types of runners.

We hope you enjoy our findings and use them to move your brand, your technology, and your products forward!

Kind Regards,

Andrew Statham  
ARION CIO & Founder








## Why selecting the right shoes for your running style matters — and how ARION can help.

### High level summary

Overall, on average across the test group, the Gel Cumulus 25 displayed an improved efficiency index compared with the 24, with little influence on the safety index. On the other hand the GT-2000 showed a general improvement in the injury index with limited influence on the efficiency index. On a participant level further insights can be gained and are explored in more detail later in this report.

### Key takeaways

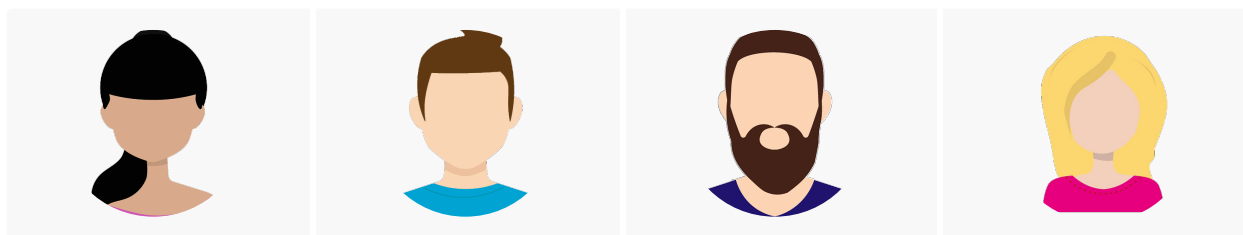
-  Efficiency index increased for the Gel Cumulus 25 compared to the Gel Cumulus 24
-  Safety index increased for the GT-2000 12 compared to the GT-2000 11
-  Footstrike is increased for the Gel Cumulus 25 compared to the Gel Cumulus 24 & decreased for the GT-2000 12 compared to the GT-2000 11

### Introduction

This experiment was conducted using ARION Smart Insoles and software based on over 15 years of R&D and multiple patents. Eight nanotech sensors capture lab-quality movement data directly from within the shoes of the participants.

The ARION algorithms then process the data to generate insights into the performance of the runners across the various footwear options. We then categorise these insights across four major areas to help us generate insight into footwear and the influence they have on our unique human movement.

### Runners profiles



Participant	Gender	Height, cm	Weight, kg	Footstrike Y	Cadence, spm	Step length, m	Experience
Rita (28)	Female	162	70	3%	168	0.91	Beginner
Nick (31)	Male	170	63	4%	164	1.02	Recreational
Nikolay (26)	Male	175	78	20%	163	1.09	Beginner
Manouk (27)	Female	171	65	63%	161	1.05	Recreational

In this experiment four participants tested ASICS shoes, running at speeds between 8km/h and 14km/h. There is an equal distribution of gender and a minor distribution in height, weight and age. Two out of four participants are beginner runners, running only a few times per year. The other two are recreational runners, running around two times per week.

All participants have their own body types, varied techniques, unique anatomies and personal goals. All of these elements heavily influence the way we move. Each contributes to our individual biomechanical profile, our unique **running identity**. This is seen in key metrics averaged over all runs per participant. Two participants, Rita and Nick, have a pronounced heel landing evident from the low Footstrike Y values below 5%, Nikolay has higher Footstrike Y values around 20% indicating a light rear- to mid-foot strike. With a clear forefoot landing, Manouk has a substantially higher Footstrike Y of around 63%. Notably, Rita had the highest cadence and lowest step length, whereas all the other runners are within comparable ranges of each other.



# Why selecting the right shoes for your running style matters – and how ARION can help.

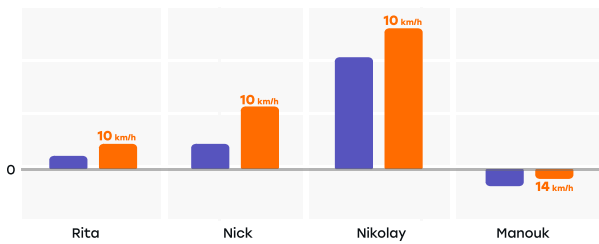
## Efficiency index

The efficiency index indicates the amount of energy used by the runner, where a high efficiency index indicates a lower energy consumption. In the graph, the efficiency index is visualized as the average difference of the Gel Cumulus 25 compared to the Gel Cumulus 24 and the GT-2000 12 compared to the GT-2000 11 per participant. A positive value indicated an improved efficiency for the new model. The highest efficiency benefit experienced by each runner is also shown with the associated speed at which this efficiency was achieved, to provide reference compared to the average across all speeds. (This may be a relevant reference since it is evident from our broader data base that for one runner different shoes can perform better at different speeds.)

Efficiency increased for most participants for the Gel Cumulus 25 compared to Gel Cumulus 24, with the biggest improvement visible for Nikolay. The highest improvement in efficiency was reached by running 10km/h for these participants. Only for Manouk, who is a forefoot lander, the Gel Cumulus 25 appears to have negligible to slightly negative influence on her efficiency.

### Gel Cumulus efficiency comparison

- Average efficiency index difference between the **Gel Cumulus 25** and **24** across all speeds, per participant.
- Highest efficiency index difference according to preferred running speed per participant.



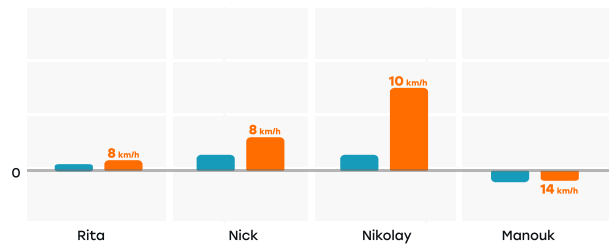
It may be interesting to explore further if this shoe design is consistently better suited for rear and mid-foot landers with regards to efficiency.

Overall the GT-2000 12 shoe efficiency was generally comparable to the GT-2000 11 with little differences for most participants, when averaged across all speeds. Efficiency appeared to be slightly increased for the male participants, particularly for Nikolay who has a light heel to mid-foot landing, in the GT-2000 12 compared to the GT-2000 11. For females there is little difference between GT-2000 12 and 11, although, interestingly, Manouk, who has a forefoot landing, appears to consistently show a slightly lower efficiency index when running in the GT-2000 12 across all speeds compared to the GT-2000 11.

According to the highest efficiency results, it seems there may be a trend emerging correlating the highest efficiency results for higher footstrikes, at higher speeds, but a larger test group would be required to investigate this further.

### GT-2000 efficiency comparison

- Average efficiency index difference between the **GT-2000 12** and **11** across all speeds, per participant.
- Highest efficiency index difference according to preferred running speed per participant.



## Safety index

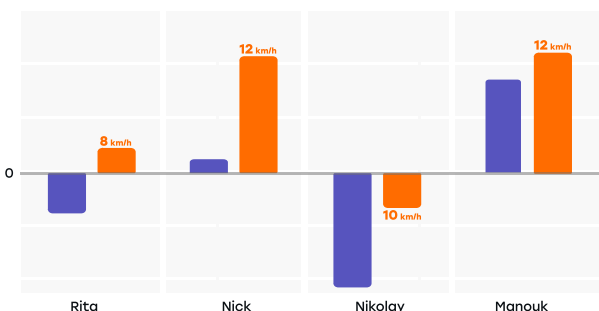
The safety index, or injury risk index indicates how 'safe' the shoe is when you run, where a high index indicates lower risk of developing an injury. In the graph, the index is visualized as the average difference of the Gel Cumulus 25 compared to the Gel Cumulus 24 and the GT-2000 12 compared to the GT-2000 11 per participant. A positive value indicated an improved safety index for the new model. The optimum injury risk benefit experienced by each runner is also shown with the associated speed at which this index was achieved, to provide reference compared to the average across all speeds. (This may be a relevant reference since it is evident from our broader data base that for one runner, different shoes can perform better at different speeds.)

The Gel Cumulus 25 differently affects the safety index compared to Gel Cumulus 24. Nick and Manouk show an improved index in the Gel Cumulus 25, with Manouk having the highest improvement.

Safety increased for all participants in the GT-2000 12 compared to the GT-2000 11. The highest increase in the safety index is seen when the participants ran between 10 and 12 km/h, with the more pronounced heel landers experiencing more benefit at the higher speeds.

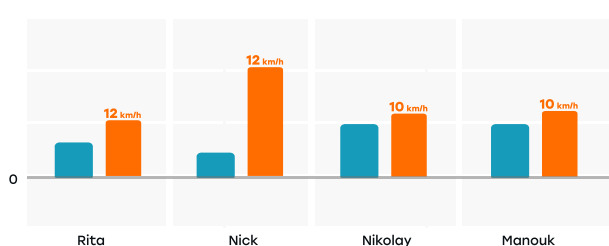
### Gel Cumulus safety comparison

- Average safety index difference between the **Gel Cumulus 25** and **24** across all speeds, per participant.
- Highest safety index difference according to preferred running speed per participant.



### GT-2000 safety comparison

- Average safety index difference between the **GT-2000 12** and **11** across all speeds, per participant.
- Highest safety index difference according to preferred running speed per participant.





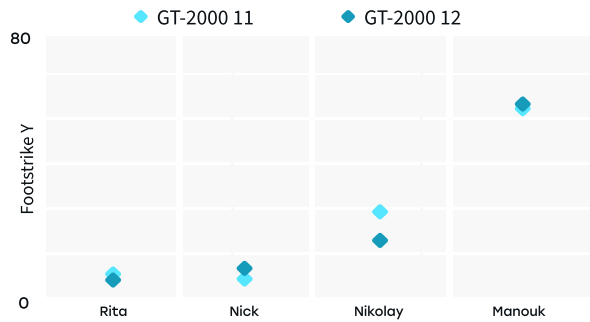
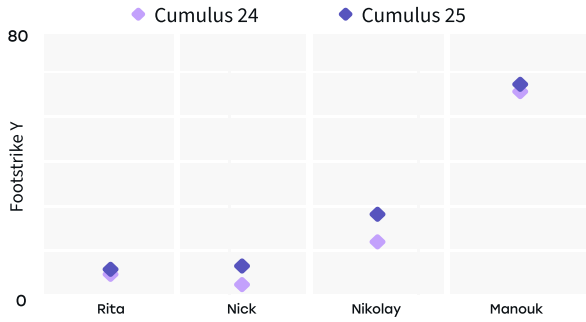
# Why selecting the right shoes for your running style matters — and how ARION can help.

## Footstrike Y

From the gaitline, the Footstrike Y can be extracted. This refers to how the foot is placed on the ground at initial ground contact, with lower values indicating contact closer to the heel and higher values indicating contact closer to the toe. In the graph, Footstrike Y is visualized for each runner.

Footstrike Y increased for all participants in the Gel Cumulus 25 compared to the Gel Cumulus 24, with the most pronounced differences seen in Nick and Nikolay's data. This might suggest the Gel Cumulus 25 having a softer midsole or is allowing the runner to reduce the contact angle slightly, which might be an effect of a lighter weight shoe.

Footstrike Y is differently affected by the GT-2000 12, with most participants experiencing very slight to negligible differences, with the exception of Nikolay, who has a light rear- to mid-foot landing. Nikolay appeared to experience a slightly more pronounced decrease in Footstrike Y.

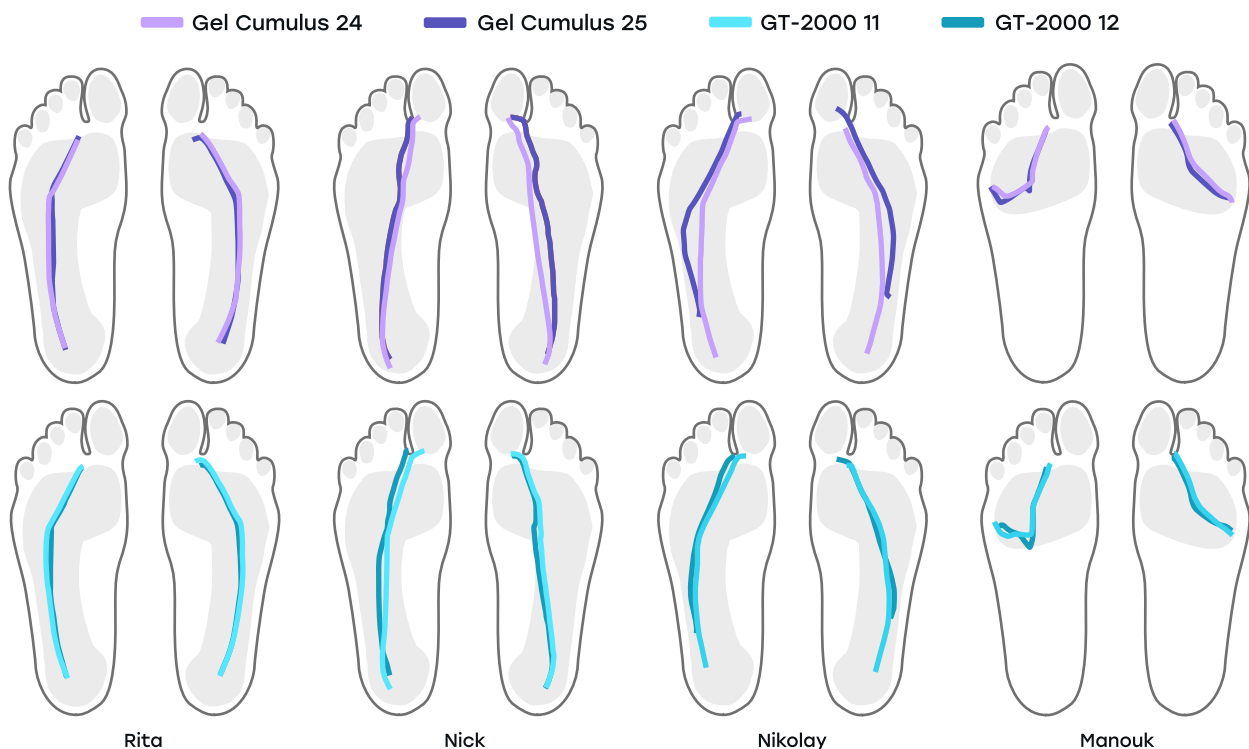


## Gaitlines

The gaitline represents the roll of the foot, visualizing the dynamics of the foot during each step. The gaitline can be considered as a representation of the way in which the foot moves through the shoe during a step. In the images below, the gaitline of each participant, when running at 10km/h, is shown with lighter colors indicating the older model (Gel Cumulus 24 or GT-2000 11) and in darker colors the new model (Gel Cumulus 25 or GT-2000 12). All participants have very different gaitlines; Rita and Nick land with the back of their heel first, with the foot rolling through to the forefoot. Similar response is seen for Nikolay, although more variation is seen in his landing. During the mid stance, the phase where the body decelerates and moves over the foot, Rita's and Nikolay's gaitline remains more lateral or on the outside of the foot, whereas Nick moves over the medial or inside of the foot. Manouk lands with the outside of the forefoot, after her foot flattens, before moving forward towards the toes.

For both Nikolay and Nick, the start of the gaitline of the Gel Cumulus 25 is more towards the mid-foot compared to the Gel Cumulus 24, with the biggest difference seen for Nikolay. For the same runners, during the stance phase the gaitline moves more laterally for the Gel Cumulus 25 compared to the Gel Cumulus 24. For Manouk and Rita minimal changes are visible for the gaitline.

The GT-2000 12 minimally affects the gaitline compared to the GT-2000 11 for all runners, except for the start of the gaitline for Nikolay. Similarly for the Gel Cumulus 25, the start of Nikolay's gaitline in the GT-2000 12 is more towards the mid-foot compared to the GT-2000 12.





## Why selecting the right shoes for your running style matters — and how ARION can help.

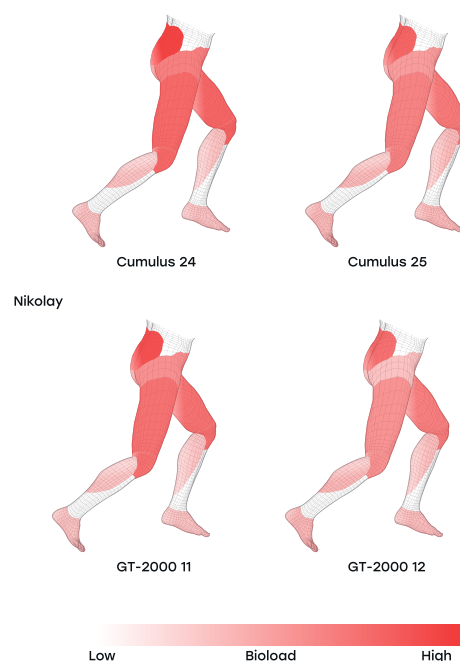
### Bioload

The bioload represents what body parts of the lower body are experiencing loading. The images on the right show the bioload for Nikolay wearing all four different shoes when running 10 km/h. The bioload for the rest of the participants can be found in the [supplementary material](#). The deeper the red colour of the body part, the higher the estimated load is for that specific body part.

In general, for Nikolay the lower back, upper leg and knee are estimated to experience the highest relative loads. A similar response is seen for Rita and Nick. For Manouk her feet and calves experience the higher loads. This highlights the different responses of different individuals to the same shoe.

For Nikolay, both the Gel Cumulus 25 and GT-2000 12 resulted in a slight decrease on the load of his upper leg and knee with a very slight increase in the loads on the foot and lower leg compared to the Gel Cumulus 24 and GT-2000 11 respectively. Overall, the new models resulted in a more equally distributed bioload.

Similar to Nikolay, Nick shows a more even load distribution for the new models compared to the old ones. Only slight changes are visible for Manouk and Rita.



### Discussion

If we step back from all the data insights, the findings show that all runners respond differently to both the new Gel Cumulus and GT-2000 compared to their previous, even though, demographically, they could be considered to be very similar individuals (in terms of age, height, weight, etc.). Overall, on average across the whole test group, the efficiency index generally increased for the Gel Cumulus 25 compared to the Gel Cumulus 24 (for 3 out of 4 participants). Notably the forefoot runner in the group saw little to no difference between the Gel Cumulus 24 and 25.

On average across the whole test group the the safety index increased for the GT-2000 12 compared to the GT-2000 11.

Regarding landing and roll of the foot, the Gel Cumulus 25 showed a slight increase in footstrike for all participants and for the gaitline to move more laterally for two participants. Both the new Gel Cumulus and GT-2000 caused an overall decrease and more evenly distributed bioload for two participants compared to the previous version. Only minor changes in bioload are visible for the other two participants.

### Important notes

- The efficiency seems to be slightly lower in the Gel Cumulus 25 compared to the Gel Cumulus 24, whilst safety index slightly improved for the forefoot striker in the test group. It may be worth expanding the test group to see if this is a consistent result for forefoot landers and explore this further.
- There is some indication that preferred running speed and possibly footstrike may play a role in how much benefit runners may experience from the Gel Cumulus 25, this may be worth testing further to explore if this is consistent with a larger test group. Comparably the injury risk index relation to speed and footstrike may be interesting to investigate.
- For two participants, during the stance phase the gaitline moved more laterally for the Gel Cumulus 25 compared to the Gel Cumulus 24, which may be interesting to explore further with extreme pronators/supinators.

### The importance of running identity

All of our insights are supported by our database of over one million unique digital footstrikes. This data has been captured through a decade, from thousands of participants within diverse environments.

With every step taken in our ARION Smart Insoles, we gain further insight into human movement. Biomechanics is a rapidly evolving field, and our research is continually expanding our understanding of the complexity and uniqueness of the way we move.

Combined with research and expertise from world-renowned institutions, it guides us to generate our vast knowledge and obsession to decode human movement.



### Bioloads

The bioload represents what body parts of the lower body are experiencing loading. The images below show the bioload for all participants wearing al four different shoes when running at 10 km/h.



Rita



Cumulus 24



Cumulus 25



GT-2000 11



GT-2000 12



Nick



Cumulus 24



Cumulus 25



GT-2000 11



GT-2000 12



Nikolay



Cumulus 24



Cumulus 25



GT-2000 11



GT-2000 12



Manouk



Cumulus 24



Cumulus 25



GT-2000 11



GT-2000 12



Low

Bioload

High

“ We digitize human movement  
to accelerate breakthrough innovations  
that move the world forward ”

## Would you like to get in touch?

The movement report is an example of how our ARION innovations utilize cutting edge technology to unlock value at every level of the sports and health industries. It represents a true reflection of our brand statement.

Want to see how our data can move you forward? Reach out to our team and subscribe to our social channels to receive the latest insights from the ARION Lab.



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