First principles: Reasons to always go back

I did a double take when I received an email from a friend with the subject line 'How to run "naked" – and love it'. My immediate thought was that he had lost his marbles, but I clicked on the link not quite sure what to expect. My concern was ill-founded because the link directed me to a blog about the joys of running free of smartphones, heart-rate monitors, headphones, GPS devices, etc.; 'naked' was referring to the deprivation of technology.[1] The article implied that technology, which has become such an important part of running, detracted from the natural joys of running – the very thing that was attractive in the beginning. This prompted a tongue-in-cheek response from another friend, David, a once-elite race walker, who was on the mailing list:

'Thanks for the info on the devices. Looks very interesting. My watch broke about 15 years ago; never used the other devices. So, I guess I've been running "naked" for a while. I still use my original HR, BP, O_2/CO_2 sensors located in various locations in my body. Forgot where? They provide continuous feedback to some device that then adjusts HR, O_2 extraction and CO_2 loading, respiratory volume and rate. This according to some algorithm that apparently accounts for energy status/demand. Works well; I don't even have to think about it.'

While this was said in jest, it was insightful and summarises the concept of the central governor.[2] This theory explains the anticipatory regulation of pacing during exercise, and occurs independently of any external hardware or software. David's comment and the blog got me thinking about how easy it is to drift away from first principles. We are quick to embrace technology, particularly if the new technology measures something that we can use in research, in service to clients or patients, or if we think it is going to improve performance. However, if first principles are neglected, the accuracy of the measurement may be questionable. First principles imply that the following questions can be answered:

- How reliable is the measurement?
- Is the measurement valid?
- Does the measurement respond to changes with sufficient sensitivity?
- Is the measurement error less than the smallest worthwhile change?

These are simple first-principle questions, the answers of which should be known before the measurements are applied. Alas, this often does not happen, and tests or devices that measure things are often used and applied before they have undergone this source of evaluation.

There are many examples: Consider the portable lactate analysers that became fashionable about 15 years ago.[3] While they could measure lactate concentrations in a tiny blood sample obtained from a finger prick, the measurement error exceeded the smallest meaningful change in lactate concentration during exercise. An understanding of first principles would have exposed the pitfalls in measuring lactate as a marker of training status. A situation where the measurement error exceeds the smallest worthwhile change makes the measurement uninterpretable. Despite this, many trainers and coaches insisted on measuring lactate during exercise and still do so today; the only conclusion is that they do it to look smart, because the practical outcomes of such a measurement are questionable.

Perhaps the most outrageous example of not understanding first principles was a nutritional supplement that was marketed as an adenosine triphosphate (ATP) replacement. The manufacturer of the supplement glossed over the fact that ingested ATP gets broken down as it is digested and does not reach the muscles and increase the concentration of ATP as claimed. A consumer without the first-principle knowledge of digestion and metabolism would miss the faulty logic and could easily succumb to the pitfalls of such claims.

Therefore it is important for practitioners to revisit first principles governing their discipline. It is important for students to be taught using first principles as the basis of their learning. The public should also be educated about the mechanism of action of treatments and be encouraged to adopt a questioning, skeptical outlook. Finally, it may be appropriate to have a 'running naked' day just to remind us of the importance of first principles.

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References

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