

Insights from a decade of scientific support within professional boxing

Dr Alan Ruddock FBASES, recipient of the BASES Applied Practitioner Award, highlights the challenges and opportunities of providing scientific support to professional boxers.

Introduction

The date is 28th May 2014, and we have just registered the domain name boxingscience.co.uk. We aimed to introduce the website to the world in early September, so the summer months were spent scribbling on whiteboards and fumbling around trying to build a website without knowing how to build a website. At this point, despite working with professional and amateur boxers for two years prior, we still knew very little about the demands of the sport and were muddling just as much with scientific support as we were with the website.

educational resources and opportunities for coaches and trainers to develop their scientific support practices are limited. Rewind to 28th May 2014; the goal of Boxing Science was, and still is, to provide sport science services and evidenced-based educational resources to boxers and combat athletes worldwide.

In addition to the challenges mentioned above, in 2014, there was 1) little precedent for sport science services within professional boxing; 2) few peer-reviewed scientific manuscripts from which to base our practice, and 3) little understanding of what determined success. These factors were compounded by

the short-time frame over which boxers are 'in-camp', the 'weight-making' process and the inherent dangers of combat. We viewed these constraints not as barriers to scientific support but as

opportunities to define our support strategies whilst respecting the informal but accepted norms within the boxing community, such as 'making weight'.

Developing a scientific support strategy

Our grounding philosophy was based on stability because, as should be clear from above, boxing is an unstable sport, and we need relative stability to make good training decisions. A boxer is 'in-camp' for 10 to 12 weeks before a contest and will be in a negative energy balance most of this time; the magnitude of which depends upon how much body mass they need to lose to 'make-weight'. Their taper usually lasts between 7 and 10 days; sparring demand peaks just before the taper and typically begins 5 to 6 weeks before their contest (their coach, who in most circumstances is independent of the sport science team, will make decisions regarding sparring volume and intensity). This leaves approximately 4 to 6 weeks to focus on training strategies designed to induce adaptations that depend on the fight strategy or the development of a specific physiological characteristic. There are two points here: 1) the above illustrates the fluidity (and potential instability) of a training camp, and 2) we do not have time to waste, so we need to optimise every part of the training process. As such, decisions are made using a combination of evidence-based practice and practice-based evidence supported by informative data collection and directed towards improving primary neuromuscular, mechanical or physiological mechanism that underpins performance.

Over time our philosophy has helped us to form a scientific support strategy encapsulated in a 5-phase cyclical process that enables the support team to engage in a system that promotes continuous improvement (Figure 1). This method allows us to; 1) observe athlete requirements through data collection (e.g., testing); 2) analyse data to explain athlete requirements; 3) apply this information to prescribe individualised training programmes; 4) monitor key outcome variables to optimise training demand; and 5) evaluate and revise processes on a micro, session-by-

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The two years before Boxing Science was born were mostly spent supporting a young professional boxer from Sheffield who aimed to become the world champion in the welterweight division. On 16th August 2014, that young man fulfilled his dream, and I was lucky enough to spend three weeks in the USA helping this young man prepare for the fight of his life and, at the same time training his gym mates who have gone on to win multiple world, Commonwealth, European and British titles.

In the past eight years, I have led sport science support for professional boxers in 14 world title, five international-title, two Commonwealth, two European, one British and two English title contests for a total of 25 elite title contests in addition to another 30 professional contests. Within these contests, I have provided scientific support to athletes who were boxing top five "pound-for-pound" ranked opponents. That is, these opponents were within the top five boxers in the world, irrespective of weight class at that time, and as such, these fights were considered among the highest standard possible in professional boxing. Throughout this article, I'll share reflections on providing scientific support to professional boxers.

Determinants of performance

On the surface, professional boxing seems simple, *hit and not get hit*. The objective is to throw more forceful and accurate punches than the opponent and win by either a knockout, technical knockout, or a points decision. Take a deeper look, however, especially at elite standard, and the chaotic nature of each contest becomes apparent, full of feints, deception and traps.

Outside of the ring, the sport is no different. It is organisationally chaotic and is fundamentally dangerous. Professional boxers risk brain, dermal, and musculoskeletal injury as well as hormonal and cardiovascular/thermoregulatory challenges from weight-loss practices. There are also 'social risks', as coaches and athletes from disadvantaged socio-economic backgrounds might have external pressures outside the sport that influence the support environment. Additionally, high-quality

This applied feature aims to address issues and areas that are often common in the real world, but are seldom covered by the usual learning mediums (university courses, journals, books, etc.). Please contact the editor if you have any ideas for future issues: editor@bases.org.uk

session, and macro, training phase/camp basis with the support team, boxers, and coaches. This not only helps our boxers, but it helps our team understand what training and nutritional strategies are working and importantly, how well.

Optimising the training process

The concept of support staff learning from the programmes they are implementing is often forgotten. Perhaps this is because in many sports, there is a strong evidence base for practice, whether reported in scientific or coaching literature, and therefore some level of confidence that a particular type of training will be beneficial to performance and a feeling that there is nothing more to learn. We did not have this luxury and didn't know what training strategies worked and *how well*; this forced us to pay close attention to data collection and analysis and what we could learn from the numbers and our boxers. Only recently have I discovered that this system is similar to those proposed in metacognition research and self-regulated learning strategies, which makes sense given that we need to learn and grow as practitioners. Furthermore, due to the nature of elite professional boxing, the preparation for each contest is unique and dependent upon, for example, the opponent, the boxer's weight class, the weight-making process and travel considerations. Therefore, direct support is provided on an intensive 1-2-1 basis; this has advantages as we are able to develop, implement and demonstrate the direct impact of support services on the performance and health and well-being of boxers; but it also slows down the acquisition of knowledge about professional boxing and limits generalisability of the training process to other boxers which has an impact on one of our major goals, to provide sport science



Above: Boxing science is specific to individual boxers and contests

and tactical skills rather than attempt to cause irreversible physical harm. It's also important to recognise that boxers who turn professional will have developed their craft in an amateur gym and that almost 75% of boxing clubs are located in the most deprived parts of the country, with 25% in the *most* deprived neighbourhoods where social inequality and risks of physical and mental health issues are high. Therefore, it's important to be aware that when sparring and multiple training demands are considerable, issues such as injury, illness and mental health problems can arise, particularly towards the end of a training camp. Indeed, at this time, my approach to support shifts from a scientific approach to a more athlete-centred holistic style to help athletes build confidence. I do this using contest-specific training, forming clear synergies between boxing technical training, physical preparation, and nutritional strategies, and, most importantly, instilling a sense of trust. Boxers are proud people and often do not want to share negative thoughts and feelings in a training camp because they see it as a sign of weakness. A balanced and objective evaluation of problems and specific solutions is a valuable philosophy during such times.

Looking to the future

We have several aims as we look forward to providing scientific support for boxers in the next ten years, and my focus will be on guiding the direction and application of this work. One key area is women's professional boxing, which is on a rapid upward trajectory in terms of awareness, participation and performance standard, and there is much work to do to help young female boxers. We have already begun to explore strength and conditioning provision in female youth boxers, develop basic performance standards and provide free training resources to embed good practice in amateur gyms. This work is coupled with gaining a better understanding of the female athlete in general to help us provide better support based specifically on females rather than male concepts that currently dominate our approach. ■

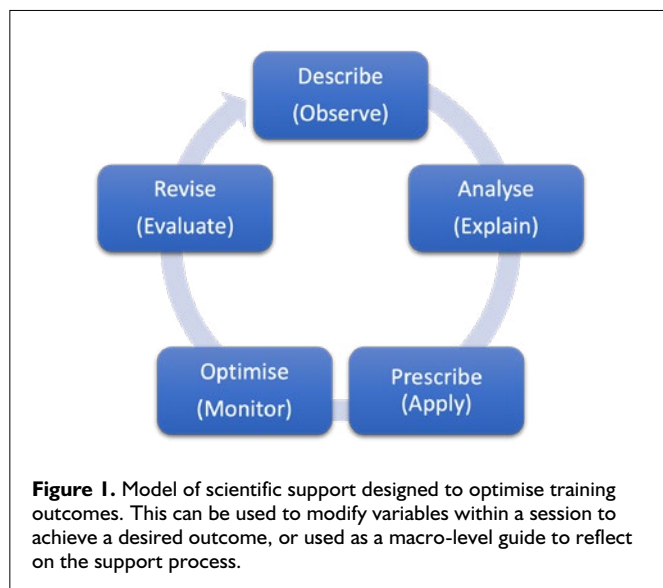
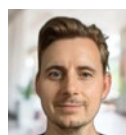


Figure 1. Model of scientific support designed to optimise training outcomes. This can be used to modify variables within a session to achieve a desired outcome, or used as a macro-level guide to reflect on the support process.

services and evidenced-based educational resources to boxers and combat athletes around the world. Nevertheless, we have drawn upon our experiences and published three key papers that provide the scientific basis for our approach to scientific support (Ruddock *et al.*, 2016; Ruddock *et al.*, 2018; Ruddock *et al.*, 2021), these resources are supported by articles on the boxing science website, videos on our YouTube channel and Instagram pages. To some it might appear as though we're giving away our 'secrets'; but the secret is not *what* we do, it's *how* we do the *what* and this is different for each boxer and the phase of the training camp.

Ethical considerations

It's also important to recognise that boxers are not thugs. Yes, they are prize fighters and have agreed to take physical punishment in exchange for financial reward, but we should not dehumanise them for this. The vast majority, especially at the elite standard, aim to win by demonstrating their superior technical



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