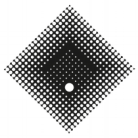

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Thinking through making and doing: sport science as an art of inquiry

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1 Thinking through making and doing: Sport science as an art of inquiry

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Abstract

How best to summarise the professional work of sport scientists? What if we were to view them as artisans? As enskiled crafts-persons who think *through* and *with* their materials? What implications would this idea have for how we take up with research and ensuing scientific methods? Here, we explore these philosophical questions – of applied relevance – through Ingold's process of making. From this perspective, skilled artisans like potters, basket-makers and sport scientists, *think through making and doing*, as opposed to *make and do through thinking*. Where the latter imposes form onto matter by way of conceptualisation, the former goes along with materials in active participation, corresponding with what such things have to say with a skilled attentiveness and selective responsiveness. We argue that the implications of these propositions for research in sport science are profound; encouraging a progression from the traditional hypothetico-deductive theory of scientific method (*make and do through thinking*), toward an art of inquiry (*think through making and doing*). In the former, phenomena are studied *about*, (re)producing categorical (sub-)disciplinary knowledge by way of vertical integration, while in the latter, phenomena are studied *with*, growing storied knowledge *of* by way of correspondence. These arguments are not to be construed as a call for more 'qualitative research' within the sport sciences, but rather to underline the value of situating *participant observation* at the core of one's inquiry. Through a prologue and epilogue, we exemplify our arguments in the very process of this paper's becoming – detailing the careful attentiveness and selective responsiveness to the various invitations to write, emergent while *thinking through making and doing*.

Key words: Scientific method, sport performance and preparation, making, doing, knowing, thinking, skill

Art does not reproduce the visible but makes visible

– Paul Klee (1920), *Creative Credo*

Prologue: On writing a paper

We (the authors of this paper) often discuss the various ways in which we write our research articles. Indeed, while it is a highly individualised process that is far from formulaic, a common thread to which we both resonate is that, to us, writing a paper often feels like we are *making something*. This means we share a sense of artisanship when writing a paper – in a similar way to what we imagine a potter feels while throwing clay to shape a vase, or a dress maker feels while knitting threads to make a garment. The process of making to which we both resonate is not one which sees us having a fully mapped out route to be followed, like the paper somehow exists as a completely-formed entity in our minds, simply waiting to be passively 'written up'. Rather, it is a process of making which sees us actively feel our way forward, carefully attending and selectively responding to invitations that open up as we weave together a larger, continually (re)forming, mesh of inquiries. In other words, the paper is not a (pre)determined 'object' waiting to be mechanically (re)produced*,* but is a determining 'thing' that actively emerges as we *find our way along.*

This process leads to a deeply situated, temporalized thinking; thinking that does not occur separate to the act of writing the paper, but that carries on *through* it. For example, while indeed we have a direction of travel when writing a paper – a large-scale invitation to act that we continually stretch toward – there exists no fixed steps to take, nor formed destinations waiting to be reached. Rather, we are selectively responsive to smaller-scaled invitations, by way of words and sentences that, when woven together, constrain our larger-scaled direction of travel. This means we are able to maintain a grip on the paper in its unfolding, anticipating its future direction, while not losing touch on the immediacy of where we are. Our anticipation, however, is not a prediction of what the paper will look like once 'finished', but is a way of helping us look ahead, in the direction we are travelling, so that we can continue to improvise a way forward.

The ensuing knowledge, then, is *grown* with our selective openness in 'making', not produced as an output of a pre-conceived idea waiting to be 'made'. That is, it is the process of the papers becoming through which our knowledge is grown. Thus, like artisans in many parts of society who actively join with their materials to improvise a way forward, we are, in a very real sense, *thinking through making and doing* when writing a paper. What you are reading, of course, is no different.

Introduction

How would a sport scientist respond if asked to describe how they support athletic performance? Ask this question, for example, of a sports physiologist, and they may provide you with information about an athlete's physiological capability – manifest through testing for various metabolic and cardiorespiratory responses to training. Ask this question of a sports biomechanist, and they might talk about formulae for various biomechanical derivatives – exemplified through an athlete's limb segment properties, joint angles, velocities and forces. A sports psychologist might reference an athlete's emotional control – represented through self-reported data on motivational status, attentional focus, and self-determination. While a sports motor control theorist may reference the role of a schema, programme or other supposed internal representation of a skilled movement. Indeed, each specialist would no doubt describe interesting facts and objective measurements; knowledge *about* performance and preparation produced through various sub-disciplinary methodologies. But the explanatory value of these genocentric outcomes – analyses scaled to the 'internal mechanics' of the athlete (Araújo & Davids, 2011; Davids & Araújo, 2010) – risk misunderstanding the very phenomenon they attempt to know and support by means of reduction, fragmentation, and classification.

How would an athlete respond if asked to describe athletic performance? Differing to the disciplinary specialists above, they may describe a range of unique, unpredictable, deeply relational and contextual *experiences* (Barker, Barker-Ruchti, Rynne, & Lee, 2012). These would likely be individualised experiences that do not belong to a discipline, and thus risk losing their richness if

reduced into pieces, structured into sub-disciplines to be known *about*. After all, "unlike academic disciplines, life does not break down into neat categories […] and we ignore them [contexts, relations, events] at our own risk" (Montuori, 2013, p. 45, text in brackets added). Such experiences in sport may, therefore, be better conceptualised as complex, emergent and entangled *becomings*: 'things' temporally suspended in an active participation with one's environment (Lave & Wenger, 1991). In other words, performance and preparation – for the athlete – may not be something that can be reduced and neatly classified into sub-disciplines to be known *about*. Rather, it is something implicit, blurred, storied and ongoing, temporally stretched between the 'not yet' of aspiration, and the 'already' of prehension (Ingold, 2015, p. 118).

What does this change in perspective imply for how we – as sport scientists – come to know the phenomena we research and support? Specifically, if the favoured *modus operandi* of research in the sport sciences is founded upon a philosophical paradigm of positivism (see Uehara, Button, Falcous, & Davids, 2014), rooted in the categorisations of the hypothetico-deductive theory of scientific method (i.e., theory-hypothesis-reduce-fit) (Haig, 2018; Woods, Rudd, Araújo, Vaughan, & Davids, 2021a), but the inhabited world of athletes is one of primary experience (i.e., relation-context-becoming) (Barker et al., 2012), are we not set upon a path of being perpetually one step behind? Of forever choosing between Scylla or Charybdis – being either too narrow and definitive to be widely applicable, or overly general and abstract such that we miss the very nuances of the phenomena we proclaim to study? If so, how could we reconcile this distinction and step out, beyond the confines of our disciplinary paradigms, and take up with a sport science, not of nouns (i.e., of 'objects' to be classified and categorised)*, but of verbs* (i.e., of 'things' becoming and transiting between states, revealing a dynamical ongoing-ness)?

In addressing this complex question, our aim here is to encourage sport scientists to take up with a sense of artisanship. To appreciate that phenomena, like an athlete's performance, are not fixed 'objects' that can only be known about through theorising, hypothesising, predicting, and fitting, but

as on-going 'things'[1], which we can study with and learn from. This distinction is critical for the arguments presented here, as the latter is found upon an ontology which appreciates that *people are things who inhabit a world never quite the same from one moment to the next*. The inspiration for these arguments stem from Tim Ingold's (2013) process of making, a notion that sees artisans *think through making*, as opposed to *make through thinking*. Where the latter thinks up ideas by way of representations in the mind to then be imposed upon formless matter by a passive body, the former goes *along* with materials in an active participation, corresponding to what such things have to say with a skilled attentiveness and selective responsiveness to improvise a way forward (Ingold, 2011, 2013).

In what follows, we discuss the implications of these notions for sport science researchers and practitioners. Specifically, we explore how they encourage a progression from the traditional – and at times positivistic and interactionist – hypothetico-deductive theory of scientific method (*making and doing through thinking*), toward an *art of inquiry*[2] (*thinking through making and doing*). To borrow terminology from the ecological psychologist James Gibson (1966), where the former focuses on categorisation and classification – a science of nouns that produces *knowledge about* objects, the latter focuses on improvisation and participation with – a science of verbs that grows *knowledge of* things. This corresponsive approach to research in the sport sciences, practised as an art of inquiry, opens the door for researchers to be responsive to a plurality of paradigms and societal ways of being. For example, to help sport scientists learn to study *with* and not just *about*, fields like anthropology can provide important guidance (see Ingold, 2018), leading researchers to (self)discover key relations in-between sources of information that could guide empirical formalisations rooted in, for example,

[1] The difference between an object and thing is not vacuous. Here, the former implies a fixed state; total, complete, bounded, waiting to be known about by being *looked at*. A thing, however, is dynamic; a *going on*, a place of entanglement with other goings on in a world continually re-forming (see Heidegger, 1971). In these entangled places, 'things' are not connected in a network like 'objects', but entwine together in a *meshwork* (see Ingold, 2011, 2015). Thus, to know of a 'thing', is to join with it in its becoming – or, in a word, to *correspond* (Ingold, 2013).

[2] Discussed in detail later, in an art of inquiry, knowledge is grown as one *goes along* with the ebbs and flows of what it is that holds their attention.

129 the science of complex systems and non-linear dynamics (Balague, Torrents, Hristovski, Davids, &
130 Araújo, 2013; Williams, Davids, & Williams, 1999).

131 What we lay out here is not just 'blue skies' of philosophical discourse, but is of deep practical and
132 applied scientific relevance. In 2019, for example, Marc Portus – one of Australia's most respected and
133 experienced sport scientists – raised issues on the possible effects of de-centralising sport science
134 support at the Australian Institute of Sport (AIS). He specifically highlighted challenges to the potential
135 for practitioners from different sub-disciplines to use a 'case approach' in an integrated manner to
136 focus on the needs of individual athletes. Portus (2019) argued that high performance sports
137 organisations, like the AIS, could be at their most effective when sport scientists, practitioners and
138 athletes work *with* one another in a 'vibrant ecosystem'. This entangled description of the future of
139 sport science delivery 'at the crossroads' raises important issues on the need to guide such integrated
140 support, dovetailing neatly with a transdisciplinary narrative on sport science research instigated by
141 Woods et al. (2021a). Thus, in what is to follow, we attempt to propose a way forward, guided by an
142 Ingoldian notion of artisanship – *making and doing through thinking*, and *thinking through making*
143 *and doing*. As an aside, while we discuss what such notions could mean for sport science practised as
144 an art of inquiry, the paths we traverse are far from complete – offering an enticing direction of travel
145 for works to come.

146 **Making and doing through thinking**

147 In our prologue, we reflected on the shared sense of artisanship felt when co-writing a paper. To us at
148 least, writing *is* making, so to view ourselves like crafts-persons feels appropriate. What, though, does
149 this mean for the thinking that takes place during the process of writing? Ask this question of a
150 conventionally trained sport scientist, and the common answer would likely be reflective of the deeply
151 pervasive positivist paradigm in which sport science is found (Abernethy & Sparrow, 1992; Pisk, 2014).
152 In such a paradigm, the common method of inquiry sees researchers formulate a hypothesis – at times
153 viewed through a theoretical lens – to be directly measured through an oft-laboratory based (in an

attempt to experimentally control the messiness of the 'lived in' world) empirical test (Araújo, Davids, & Passos, 2007; Haig, 2018; Reed, 1996b, p. 7). In other words, this approach to inquiry sees the researcher formulate ideas and representations in the mind, to then be tested against observations in the world. This traditional process is what Ingold (2013), in his book, *Making: Anthropology, Archaeology, Art and Architecture*, refers to as 'inversion', where 'lessons of life become 'data', to be analysed in terms of an exogenous body of theory' (p. 5, paraphrased). It is, in effect, to look at the world backwards, in a 'theory-before-facts' sequence, whereby phenomena are taken out of context, reduced into parts and then explained (away) by way of quasi-mechanical processes. For us, it would be to view the papers we write as a process of *making and doing through thinking*, or contradictory to the quoted words of artist Paul Klee (1920) with which we opened, it would be to reproduce the visible by way of replicating the words on paper which originate from a fully formed idea, pre-determined in our heads. Note, while discussed in detail later, inversion should not just be viewed as an issue that methodologies in 'quantitative science' need to consider, but refers to how a researcher approaches inquiry more generally.

This notion of *making and doing through thinking* has its roots in the Aristotelian model of hylomorphism – *hylo* meaning 'form', *morphism* meaning 'matter' (see Ingold, 2013, p. 20/21). The key proposition of this model is that form is imposed onto matter, founded on internalised concepts or representations created separate to the matter in which such representations are imposed. To consider an athlete performing a skill, for example, would be to retain a template of the 'technique' represented in the mind of the sport practitioner working with the athlete, predicated on an input and output. This means we would see the technique as an object to be acquired and known *about*, perhaps by way of documenting and classifying the movement components and dimensions (e.g. range, duration, accuracy) and other quantifiable properties that describe the action. Such a hylomorphic 'objectification' of the technical information would be no doubt of use in manufacturing a coaching manual that consists of 'step-by-step' instructions to be memorised and rehearsed. The caveat, however, is that we 'see' nothing of the contexts – the processes – from which a movement emerges,

capturing the skilled attentiveness of the sport practitioner in facilitating the flow and feel of the athlete's movements. In other words, it would be to separate knowing from knowledge; turning away from the becoming of things by narrowing one's focus toward a mechanistic unit of analysis which seeks only to produce and transmit post-hoc, reductionist, knowledge *about* (Lave, 1990; also see Lave & Wegner, 1991).

In the field of sport science there has been recognition of the limitations of this type of detached inquiry (see Sparkes & Smith, 2014), referencing to the need for models of applied research to bridge theory and practice (see Bishop, 2008). While we agree that this is an intuitive step in the right direction, such models do risk leading us back to the hylomorphism of *making and doing through thinking*. For example, such models often encourage sport science researchers to initially perform systematic reviews or meta-analyses to 'get across the disciplinary literature' on a topic that holds their interest, leading consumers of knowledge to identify 'gaps' around which a hypothesis can be formed (Bishop, 2008). By no means do we wish to argue that reading about phenomena is not an important aspect of inquiry in the sport sciences – nor do we mean that of systematic reviews and meta-analyses. Rather, our claim is that to really 'know of' phenomena that we wish to study – *to see things in their becoming* – we need to carefully and attentively *observe* and *participate*, in a natural ecology of relations. That is, to spend time with things, responding to what things may have to share with us, not just what the conventions of scientific method have extracted and recorded in order to tell us about. By taking up with such participant observation in sports science, we can learn *from* what it is that holds our attention, which could minimise the apparent gap noted between research questions designed by academics, and the everyday professional activities of coaches, athletes and other stakeholders deeply embedded in sporting contexts (see Fullagar, McCall, Impellizzeri, Favero, & Coutts, 2019).

Different conceptualisations of knowing

One way of distinguishing this conceptualisation of knowledge is based on what Gibson (1966, 1979) referred to as knowledge *of* and knowledge *about* the environment. The latter is understood as mediated information by way of words, data, pictures and symbols: indirect information that has been produced and documented by another human individual (Gibson, 1966, p. 91; also see Reed, 1996b, ch. 1). The former, by contrast, is direct and unmediated information that is omnipresent in the environment, available to be directly picked up and acted upon by an attentive perceiver (Gibson, 1966, 1979). It is the patterned structure of the invariant features of this information which directly specifies *invitations* to act within an environment (Withagen, do Poel, Araújo, & Pepping, 2012) – that is, its *affordances* (Gibson, 1979). This distinction is most apparent in the differences between knowing *about* a sporting landscape by reading facts and data noted by another person (perhaps documented and depicted in a coaching manual) and knowing *of* the landscapes invitations to act by way of engaging directly with (i.e., *attuning to*) its sounds, textures, sights, and smells (Woods & Davids, 2021). Indeed, both types of knowledge may be used in supporting human behaviour. But our concern here is that the predominant method of inquiry within the sport sciences has been built upon a foundation of the former source, where phenomena are only known *about* by way of second-hand information extracted through the hypothetico-deductive theory of scientific method (see Haig, 2018). Sport scientists, in this sense, could be understood as 'occupants' who mediate – by way of disciplinary convention, theory, method and concept – their interactions with the phenomena they study about. No more is this apparent than in mainstream publications and editorials that conflate 'data' and 'science' in sport as being synonymous. The word data, after all, is the plural of the Latin word 'datum', roughly meaning 'to give' – a *static representation* of the thing which it has been taken to be analysed as an object of 'fact' (Rosenberg, 2013). Such conflation, in our opinion, risk keeping sport science within its overly narrow, mechanical and determinable worldview, trivialising direct and primary experience – perhaps even demoted as being 'merely subjective' – in favour of a 'realer', more quantifiable, 'objective truth' (see Sparkes & Smith, 2014 for critique). This, we argue next, risks leading to the production, consumption and regurgitation of knowledge about phenomena, generated

through a type of hylomorphic vertical integration. Knowledge, parcelled in this way, risks over-compliance, being connected up, documented and labelled in categories and systems of classification.

Vertical integration of knowledge production

Through the notion of *making and doing through thinking*, knowledge is understood to be produced and consumed by way of higher-order vertical integration (Ingold, 2011, p. 153). By this, we mean that the concepts and hypotheses, determined separate to the phenomena one is to study, sit above the goings on of the phenomena 'at ground level', providing a drone-like perspective that leads to an understanding of phenomena as 'objects of analysis', viewed through a conceptual or representational lens (Ingold, 2011, 2013). To adopt a hylomorphic account, this would be to understand the conceptual idea, already determined in the scientist's mind by way of disciplinary paradigms (perhaps even noted as 'gaps within the literature'), to be imposed onto the phenomena analysed as an object. The resulting observations on the ground, then, are vertically fed back up into the higher-order conceptual framework to be modelled accordingly, leading to the production of new knowledge by way of classification and categorisation, altering the drone perspective of the factual landscape (Figure 1).

******INSERT FIGURE ONE ABOUT HERE******

This description of knowledge as classificatory, produced through vertical integration, is synonymous with what David Rubin (1988, p. 375) – in discussing memory – metaphorically referred to as a 'complex-structure'. In this metaphor, knowledge is understood by way of conceptual representation to be determined *before* being applied in context:

> "[…] knowledge takes the form of a comprehensive configuration of mental representations that has been copied into the mind of the individual, through some mechanisms of replication, even before he or she steps forth into the environment. The application of this knowledge in practice is, then, a simple and straightforward process of sorting and matching, so as to establish a

> homology between structures in the mind and structures [objects] in the world." (Ingold, 2011, p. 159, text in brackets added)

In the sport sciences, and in other heavily positivist disciplines (see Costanza, 2003), vertical integration has led to a fixation on *analysis* (i.e., reduce and deconstruct to produce knowledge about) at the expense of *synthesis* (i.e., observe the entangled becomings of things to know of) (Davids & Araújo, 2010). Why this is a concern, is that it risks leading us away from the phenomena by creating *organismic asymmetries* in research and practice, where the 'internal mechanics' of the athlete are viewed as somehow separated or detached from the ecology of relations in which they emerge – that is, the context of behaviours (Davids & Araújo, 2010). Moreover, this fixation on analysis can lead researchers to view phenomena, like athletic performance, not as ongoing things on the cusp of becoming, temporally stretched in-between dynamic states, but as objects that are fixed and static waiting to be split up, categorised into pieces by way of analytics; explained away by being placed into disciplines or sub-disciplinary frameworks. To us, this is *unsustainable* – closing paths of travel rather than opening them – and is why inter- and multi-disciplinarity within the sport sciences, albeit a welcomed shift toward collaborative research, can still be limiting (cf. Songca, 2007). Specifically, while a team of researchers, each bringing their sub-disciplinary speciality, work together to 'solve' a complex problem, they each still risk viewing phenomena from their own drone-like perspective of the factual landscape. That is, as objects of analysis to be known about, driven by methods underlined by disciplinary assumptions that prevent investigators from 'seeing' phenomena as an ongoing thing on the cusp of becoming (Figure 2).

******INSERT FIGURE TWO ABOUT HERE******

This approach is typically manifest by researchers in the sport sciences focusing on data collection, or recorded observations documented after the fact. Such mediated interactions leave little room to carefully *listen* to what the phenomena may have to say, or *see* what it may have to show – to critically understand what the 'data' or 'documented observation' actually mean through the process of their

very becoming. This is because phenomena – like athletic performance – are viewed deterministically, composed of objects (i.e., techniques, performance variables, manoeuvres, set plays, tactical formations) with cause (input) and effects (output), explained (hylomorphically) by way of classification into a disciplinary framework (see Morin, 2008). In other words, the "processes of making appear swallowed up in objects made" (Ingold, 2013, p. 7). Thus, by taking up with a sense of artisanship, our proposal is that we, as sport scientists, can refocus our attention toward phenomena, viewed not as objects and nouns, *but as things and verbs*. This approach transitions research that 'produces and consumes' knowledge (*about*) by way of making and doing through thinking, toward one that 'grows and develops' knowing (*of*) by way of *thinking through making and doing.*

Thinking through making and doing

Recall our earlier discussion of Rubin's (1988) metaphor of 'complex-structures', which we aligned with knowledge produced by way of vertical integration (see Figure 1). Our main critique was that such an approach left little room for understanding – *knowing of* – the very processes that led to the emergence of the 'object of analysis'. Fortunately, in contrast to his metaphoric proposition of complex-structures, Rubin (1988, p. 375) introduced that of 'complex-processes'. Where the former focuses on classifying objects based on external attributes or characteristics (aligned with Gibson's *knowledge about*), the latter prioritises the very process of the becoming of things (aligned with Gibson's *knowing of*). Thus, rather than suggesting that knowledge is produced by way of its application onto objects of the world (*making and doing through thinking*), a complex-process metaphor suggests that people come to know the things they seek to understand by way of active participation 'with' (*thinking through making and doing*) (Ingold, 2011). To use our earlier example of a movement technique – it may be better to view it, not as an object formed by way of a mental representation located inside the mind of the athlete that has been applied to the compliant body (after being transmitted from a coach), but as a processual perception-action coupling, emergent in an ongoing correspondence between an athlete's skilled attentiveness and the ebbs and flows of the

environment they are a part of. Knowledge, in this sense, is not produced through vertical integration, but *grown along sentient lines of correspondence* (Ingold, 2011, 2013).

Though, if the skilled crafts-person does not possess a formed and determined representation to be imposed onto objects of the world, what does it say about the thinking that takes place through making? Taking one step back, the mere asking of such a question may seem odd given the heavily unchallenged Cartesian and Newtonian thinking that is deeply pervasive to the sport and movement sciences, as well as related sub-disciplines of psychology and the neurosciences (see Reed, 1996a). But for skilled artisans and crafts-persons, knowledge is *inseparable* from the very processes of knowing (Lave & Wegner, 1991). In other words, to know*, is to do in place* (Woods & Davids, 2021). The implication is that to really come to know of what it is that holds our attention in sport science, we need to move from being occupants to inhabitants, sharing a place, not above in order to survey about, but dwelling *in-among* so that we can *look with*:

> "Though we may *occupy* a world of objects, to the occupant the contents of the world appear already locked into their final forms, as though they had turned their backs on us. To *inhabit* the world, by contrast, is to join in the processes of formation." (Ingold, 2013, p. 89)

Sport science practised as an art of inquiry

According to Ingold (2013, ch. 1), to practise an art of inquiry is not to describe and document what it is that holds our attention, but is to open ourselves to its *goings on* so that we can learn to correspond with what it has to say[3]. This perspective helps us to attend directly to phenomena in their becoming, not indirectly by way of theory or representation established prior to, thereby flipping the 'theory-before-facts' conventions of the hypothetico-deductive method to a 'facts-before-theory' sequence. Note, this position does not deny the importance of theory, concept or data in coming to know phenomena, but that such things do not determine observations *for* us[4]. Simply, as noted in the

[3] By 'it', we mean phenomena – like sport performance.

[4] A wonderful example of this is shown in Edward Reed's (1996a) ecological (re)analysis of Darwin's seminal experimental observations on the behaviour of earthworms. Notably, Darwin carefully *observed* that

excerpt above, it promulgates the view of phenomena not as objects, but as things, and ourselves not as occupants, but as inhabitants. This crucial distinction in anthropology signifies the importance of participant observation and primary experience for sport scientists taking up with a sense of artisanship. By this, though, we do not mean to imply an ethnographic analysis deduced through a theoretical framework, leading to the generation of qualitative data documented 'after fact'. Rather, it signifies a commitment to participant observation and understanding of primary experience that supports researchers in *knowing from with-in* (also see Ingold, 2013, ch. 1). It is this situatedness, after all, that philosopher John Dewey, in the masterpiece *Art as Experience*, argued was central to one's understanding:

> "In order to *understand* the esthetic in its ultimate and approved forms, one must begin with it *in the raw*; in the events and scenes that hold the attentive eye and ear of man, arousing his interest and affording him enjoyment as he looks and listens" (1934/2005, p. 4/5, emphasis in original and added)

In other words, observing – by way of watching, listening and feeling – the everyday goings on of the things with-in which the places they are; legitimately participating in activities as a co-inhabitant, not passively documenting what has happened as an occupant hovering above.

This idea leads to an important contention for our propositions, in that they should not be read as a simple plea for more qualitative research (e.g. ethnography) within the sport sciences (in which Sport, Education and Society has a long and esteemed history in publishing). Rather, they should be seen to argue for more *anthropological* research within the sport sciences. The difference is not vacuous, and requires brief discussion. Notably, both Ingold (see 2013, ch. 1; 2018, ch. 4) and Woods and Davids

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earthworms burrowed in such way that resulted in a greater probability of protecting their skin from damage. Drawing on Gibson's (1979) theory of direct perception, Reed (1996a) then argued (a century later) that this observation could be explained by way of the earthworm's regulating behaviour through the perception and realisation of affordances. The 'fact' that the earthworms regulated their behaviour while burrowing, observed directly by Darwin, was thus explained 'theoretically' by Reed (1996a). Theory, in this sense, can help us understand what we directly observe and primarily experience in the world we inhabit.

(2021) argue that the former, ethnography, is *documentational*, describing what one is observing as a by-stander, perhaps even occupying a *drone-like* perspective relative to the phenomena one seeks to know (about). After all, what the word ethnography literally *means* is a 'description of people' – *ethnos*: 'people'; *graphia*: 'description' (see Ingold, 2013). Comparatively, anthropology is *transformative*, seeking to study with and learn from people through an active participation. This, in the words of James Gibson (1979), would be to undergo an *education of attention* to the everyday goings on of the things we seek to know. In sport science, such an anthropological appreciation to research would see scientists deeply embedded *with-in* a sports organisation, learning to progressively resonate with its rhythms by spending months or even years corresponding with coaches, athletes and other stakeholders, as they improvise a way forward, together.

What we are advocating here is, in effect, to practise the two-century old Goethean approach to science – a science that commits itself to doing away with explanations and classifications of phenomena-as-objects, known about through means of reduction and reification (*making and doing through thinking*), instead entering into a *conversation* (or correspondence) with phenomena in its becoming. Such a corresponsive approach to science opens up new ways of knowing – leading us to ask of ourselves, not "how can I find ways of adapting the phenomena to my specific approach so that I can answer my question?", but "*how can I make myself into a better, more transparent instrument of knowing?*" (Holdrege, 2005, p. 31, our emphasis)[5]. This perspective threads us neatly back to the practicality of our propositions, supported by the earlier accounts of Portus (2019) outlined in our introduction. Specifically, by viewing research within the sport sciences as an art of inquiry, thereby engaging in participant observation, sport scientists can develop with coaches, athletes and other stakeholders in a corresponsive, blurred, entangled, and *transdisciplinary* way (which is perhaps what Portus (2019) meant when referring to the need for a 'vibrant ecosystem'). This development in sport science is not forged through a rigid hypothesis-driven question developed ex-situ and retrofitted to

[5] For a detailed insight to works of Johann Wolfgang von Goethe, we encourage readers to visit Craig Holdrege's (2005) wonderful paper, titled, *Doing Goethean Science*.

a specific performance context. Rather, it is created by a *delicate hope* of finding a way to carry on (Ingold, 2018), in a unique direction, together; growing knowledge *of* and *with* phenomena in contexts of practice and performance. Note, such propositions do not diminish the importance of experimentation. Rather, when practised as an art of inquiry, experimentation is not just about proving or disproving hypotheses developed in advance, tested in de-contextualised settings, but is about *giving things a go* – watching, listening, and feeling to how things respond in place – not to know more, but to help us *know better.*

We have elaborated, at length, on the potential value of transdisciplinarity for the sport sciences elsewhere (see Woods et al., 2021a), but here, it is important to briefly re-visit four dimensions of transdisciplinary research as outlined by Alfonso Montuori (2013) given their practical alignment with Ingold's (2013) art of inquiry. First, transdisciplinarity is inquiry-based, not disciplinary-based. This means that research questions should emerge, not just from (pre)formed ideas or disciplinary concepts developed ex-situ, but through continued correspondence *with* phenomenon that has caught our attention, leading one to (self)discover what it has to say. Montuori (2008) suggests that because of the deeply personal interest which drives transdisciplinary research, this approach pushes against 'reproductive education' – where an established body of knowledge is consumed and reproduced in order to comply with tenets of a defined disciplinary framework or concept (perhaps intended to 'fill gaps within the literature'). Thus, given the sense of misfit and nomadism associated with this first dimension, the sport science researcher practising an art of inquiry could be understood, not just as an artisan, but as a *perpetual traveller*[6] who weaves together pertinent lines of inquiry as they go:

> "Inquiry means exploration and feeling alive, it means welcoming the mystery of life, not in order to control it but to more fully *participate* in it […] The more you inquire, the more the world is a

[6] We borrow this phrase from Woods et al. (2021a).

source of wonder […] in the sense that every new advance probably exposes more new *unknowns*." (Montuori, 2008, p. 17, paraphrased)

Second, transdisciplinarity adopts a complex systems perspective, which counters the traditional, reductionist, interactional and internalised notion of *making through thinking*. Moreover, this perspective encourages researchers to view phenomena as things (not objects) – that is, as *places of entanglement*. This implication has profound meaning for researchers in the sport sciences, as it emphasises that to know of phenomena is to be able to correspond with its story of becoming, moving along with its direction of travel (Figure 3). For it is along these places of correspondence where stories are bound together in relation, leading to knowledge growth (Ingold, 2011). Thus, *to know a phenomenon, is to know its story*. Perhaps, then, sport scientists practising an art of inquiry could see their research as a way of storytelling, going along with the messiness of the lived-in world by transcending passive descriptions about it – manifest in data and 'hard facts'[7]. A a brief note regarding our use of the word 'relation': we mean it not as an interaction between complete and bounded entities as objects, but as a (re)tracing of the primary experiences of things (Ingold, 2011). From this perspective, 'to relate' is transactional, joining with the stories of others.

For a sport science practised as an art of inquiry, tools and measures from complexity science and dynamical systems theory could help researchers formalise a phenomenon's entangled story of becoming. To exemplify, in a team game like football, the cluster-phase method could be used to understand the synchrony of player movements – both as a whole team and between individuals within a team – as a function of time, ball possession and field direction (Duarte et al., 2013). Further, various social network analyses could be used to resolve path-dependent passing behaviours by adopting measures such as centrality (Passos, Araújo, & Volossovitch, 2016). The point here is: sport science practised as an art of inquiry can help researchers move from the collection of isolated,

[7] For a wonderful insight into the power of storytelling in philosophy and science, see Thom van Dooren's gripping book (2014), *Flight Ways: life and loss at the edge of extinction*.

reduced and static performance variables, captured 'after fact' (noun-based sport science), toward the measurement of deeply-contextualised behaviours emerging in real-time (verb-based sport science)[8].

******INSERT FIGURE THREE ABOUT HERE******

The third key dimension of transdisciplinarity, as proposed by Montuori (2013), is that researchers study with, not about. This means that they include themselves in the inquiry through careful participant observation, not hovering 'drone-like' above in the hope of maintaining 'objectivity' (as the hypothetico-deductive theory of scientific method would advocate). For it is the latter that some argue is the very foundation of scientific inquiry:

> "But science as it stands rests upon an impossible foundation, for in order to turn the world into an *object* of concern, it has to place itself above and beyond the very world it claims to understand. The conditions that enable scientists to know, at least according to *official protocols*, are such as to make it impossible for scientists to *be* in the very world of which they seek knowledge." (Ingold, 2011, p. 75, emphasis added and in original)

By engaging in participant observation, researchers in the sport sciences can remain 'in touch' with a phenomenon, situated in its field of relations (for a recent example of this, see O'Sullivan, Vaughan, Rumbold, & Davids, 2021). This proximity leads to a deep and storied understanding, as the researcher is not just passively documenting events – leading to the production of knowledge about – but is actively transforming *with* what they directly experience and discover for themselves – growing knowledge of. To revisit the earlier mention of Goethe, how could one maintain a conversation with what has caught their attention, if they are forever hovering above events in order to be 'objective'? For by trying to remove oneself, we argue, would be to perpetuate the very epistemic dualism that underlines *making and doing through thinking*. Though, this proposition should not be confused as

[8] While an account of dynamic systems modelling within the sport sciences is beyond this papers direction of travel, we encourage interested readers to consult the work of Araújo and Davids (2016) for a detailed overview.

441 lessening the importance of searching for truth within a sport science practised as an art of inquiry.
442 Rather, the pursuit of 'objectivity' and the pursuit of 'truth' should not be conflated as being one and
443 the same – for where the former is detached from the world, the latter participates deeply with it.
444 The pursuit for truth, then, is an ongoing, sustainable practise of *curiosity* and *care* – a curiosity that
445 compels one to *re*-search, and a care that sees one concerned about getting the right things, right
446 (Ingold, 2018; Rietveld, 2008, p. 468).

447 This pursuit requires attentiveness and selective responsiveness, both to the immediacy of the
448 situation in its unfolding, and to events emergent on the horizon such that one is able to anticipate
449 where to move next. As an aside, our interpretation of anticipation is influenced by both van Dijk and
450 Rietveld (2018) and Ingold (2013), who discuss it not as a prediction, but as a deeply embedded
451 practice of current activity that constrains and keeps open a larger-scaled direction of travel. This
452 approach, importantly, highlights a potential misunderstanding of sport science practised as an art of
453 inquiry. Specifically, if the sport scientist is to view themselves as an artisan who *thinks through*
454 *making and doing*, what role then, does planning have? In response to this question, we draw from
455 Keller's (2001) account of an 'umbrella plan', which is understood as a basic assembly of "a
456 constellation of tools and material to carry out the project" (p. 35). Indeed, although an umbrella plan
457 requires forethought on behalf of the researcher, it is thinking not separated from the context in which
458 the phenomenon occurs (Keller, 2001) – meaning, it is *part of the process of making*. This approach
459 would exemplify a researcher embedded within a sports organisation, making key decisions upon
460 which stakeholders to discuss observations with, which meetings or activities to record and how (i.e.,
461 field notes, measurements, analyses, experiments, videos), and which tasks to participate in. Each of
462 these things is constrained by, and woven into, the very fabric of the sociocultural context one is
463 situated: meaning they do not occur separate to being with the organisation, nor are they solely
464 confined to the mind of the researcher. An umbrella plan, then, is stretched through the entirety of
465 the organisation in relation to the sport scientist's attentive and responsive participation with the ebbs
466 and flows of the everyday goings on. This means that contrary to popular belief, to anticipate where

one is going, it is not a requisite to log or plan out every step in-advance – nor even to have a determined 'end' in sight – so long as one maintains a selective openness to the available invitations to act, enabling them to *carry on* (Ingold, 2013; van Dijk & Rietveld, 2018). In other words, an umbrella plan – in sport science practised as an art of inquiry – provides intentionality, which does not determine the research but *guides its determining, shaped by the embodied, skilled attentiveness and responsiveness of the researcher within-in the ebbs and flows of place.*

The last dimension of transdisciplinarity is that it is meta(trans)-paradigmatic, not intra-paradigmatic (Montuori, 2013). This view frees sport scientists from the perhaps hidden and unchallenged shackles of their path-dependent disciplinary ways of doing, endorsing a refusal to conform (Montuori, 2005). This approach means that sport scientists can be responsive to many different ways of doing and being, opening themselves to other paradigms such as interpretivism to explore how 'forms of life' in sport organisations and institutions emerge through variations in everyday activities (for recent examples, see Uehara et al., 2018; O'Sullivan et al., 2021; Vaughan et al., 2019). Our own research on enskilment within the sport sciences (i.e., learning as inseparable from doing in place) has seen us correspond with paradigms from fields like anthropology and ecological psychology (see Woods et al., 2021b). The point here being: sport science practised as an art of inquiry does not integrate knowledge vertically (i.e., within disciplinary paradigms), but grows it along paths of travel – *in-between*, *through* and *beyond* landscapes.

Conclusion

By advocating for sport science as an art of inquiry, we sought to refocus attention toward the phenomena in context, thereby challenging some traditional conventions of sport science founded upon the hypothetico-deductive theory of scientific method, which advocates reduction, fragmentation and classification. Through a notion of artisanship, we argued for sport scientists to *think through making and doing* (emphasising a verb-based approach), as opposed to *make and do through thinking* (demoting the current noun-based dominance). Where the latter integrates

knowledge-as-production by way of verticality, the former grows knowledge through correspondence, joining with the stories of things in their becoming, carefully attending and responding to what such things have to say, and where such things have to lead. This makes sport science practised as an art of inquiry, both *wonderous* and *wandering* – unbound by conventional ways of doing or being. Because of this, it is humble, rooted in its ontological commitment that we – as sport scientists – *are also things, who have as much to learn from the phenomena we study, as the phenomena from us*. This is why sport science practised as an art of inquiry is transformative, *in-among*, rather than documentary, *out-above*.

In following key ideas advocated by van Dijk and Rietveld (2018) and Ingold (2013), we argued that researchers in sport science practising an art of inquiry are indeed able to maintain a grip on the immediacy of the goings on of things, while concurrently looking ahead to improvise a way forward. This means that sport scientists do not need to plan every step out in advance, nor do they require fixed end-points or destinations. In fact, the mere suggestion of such would go against its very ontological commitment. This proposition draws into question the inherent determinacy of traditional systemic conventions of training within the sport sciences, like that of doctoral candidates who are often required to present a proposal of research covering three or more years of study within only six months of enrolment. Such determinate planning risks leaving little room for attending and selectively responding to what phenomena may have to say – *to correspond with its story of becoming* – leading to an inadvertent hylomorphism. This is because, to us, sport science is founded upon an oft-unchallenged epistemic dualism – separating knowledge from the processes of knowing – viewing phenomena as objects of analysis, not as things of synthesis temporally suspended in movement. What this can risk leading to is a view of sport science as one of determinable rule following, which fails to appreciate the skill of the researcher. For as philosopher of science Joseph Rouse (1987) suggests, “science is first and foremost knowing one’s way about in the laboratory (or clinic, field site)” – implying that it is the craft (or dare we say, *artisanship*) of the scientist which leads to (re)discovery, not abstract universals or passive rule following. Thus, it is our belief that by bringing together

knowledge with its process of growth, thereby appreciating the skilled artisanship of researchers, sport scientists practicing an art of inquiry can progress the field forward, into places not determined, but *determining as they go*.

Indeed, there may be those who contend that what we have proposed here is overly esoteric or perhaps even 'too soft' in scientific discourse. To this, we would respond by saying that sport science practised as an art of inquiry is intended to be replete with emotion and feeling – *it should matter to us; we should care about it*. If this is deemed as being 'overly philosophical' or not 'objective enough' for mainstream science within sport, then perhaps it is more telling of the state of sport science, than of our propositions. After all, should we not care about what we spend our time coming to know and how? Should we not immerse ourselves with-in what captivates and matters to us? Should we not be open and responsive to what we study, as sport scientists? In answering such questions, we may not just come to know what we seek to understand through shared primary experiences as inhabitants – *in-among* – but we may also come to better know ourselves in the very midst of becoming.

Epilogue: To write a paper, is to carry on with

We now find ourselves at a point of this paper in which convention would say that it is finished, or at least finishing. But to say that this paper is finished, is to have missed its very point. For it would be to assume that we had a fully formed idea at its 'beginning', simply waiting to be written up – *to reproduce the visible by way of making through thinking* – matching what you are reading against an idea determined prior to. The reality, though, is that where we are now is a place that has emerged through attending to smaller invitations to write as we followed the paper in its unfolding. This means that our thinking was very much emergent through the words and sentences written, reflected upon and woven together while improvising a way forward. While this did require forethought, it was thinking not isolated to our minds, as if being some higher-level 'cognitive' process going on separate to the paper. But it was rather spread across, and constrained by, the many conversations, coffee shops, emails, books, drafts, sketches, notes, reviewer and editor comments and suggestions, and

numerous places in which we walked and jogged while attending and selectively responding to our paper's direction of travel. That is, it was stretched across the various timescales of the paper's becoming, situated within its manifold relations.

So, to us, this is more like pause – a moment of inhalation – catching our breath while searching for a way to *carry on*, toward the next place, wherever or whatever that may be. Importantly, as our knowledge has grown through the process of this paper's becoming, we are not the same sport scientists we were when writing the prologue, or sections thereafter. This is because we learnt *from* the process of this paper's becoming. It has, in other words, been transformative rather than documentational; processual rather than projective; you have been reading *with* us, not *about* what we have written.

By implication, if there is no finish to this paper, then there was no beginning. This is to say that this paper is a continuation of our ongoing wayfinding, entangled somewhere in-between where we have been, and where we are going (wherever that may be). What could be said, then, about the papers we write – such as this – if our concern is less to view them as 'phrase books', finished, manicured products filled with determinate content explicitly chosen to be transmitted into the minds of others, and more to view them as places of goings on, entangled off-shoots leading out in various directions that attentive readers can selectively respond to while going along their own personal direction of travel? In thinking through this question, we stumbled into the resonate words of essayist, Rebecca Solnit (2001, p. 72, emphasis added), who, like us, views the books she writes not as objects with end points, but as ongoing things, wandering off through various terrain:

> "To write is to carve a new path through a terrain of the imagination, or to point out new features on a familiar route. To read is to travel through the terrain with the author as the guide – a guide one may not always agree with, but one who can at least be counted upon to take one *somewhere*."

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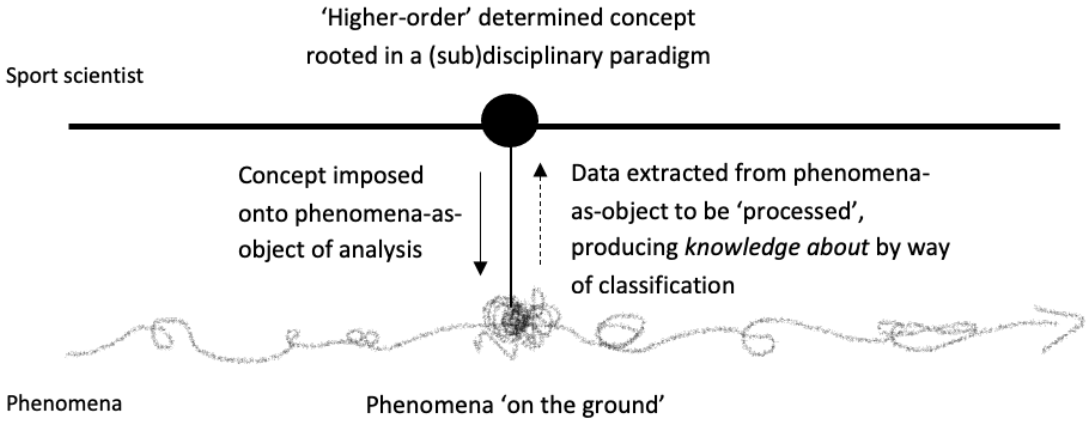
667

668 **Figure 1.** The vertical integration of knowledge production in *making through thinking*

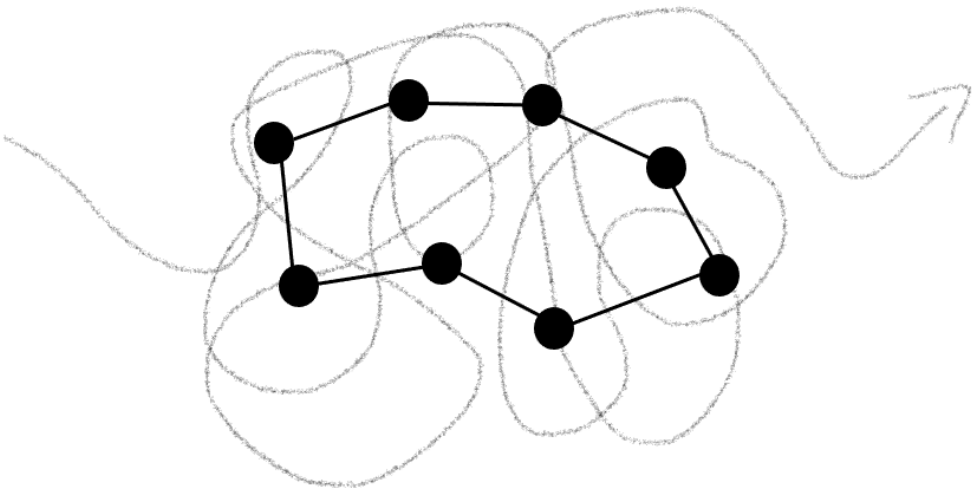


669

670 *Note*, the straight black line denotes the sport scientist occupying a world of objects to be known
671 about by way of concepts, theories and paradigms, while the shaded grey of the phenomena inhabits
672 of world of things; blurred, messy and stretched along paths of travel

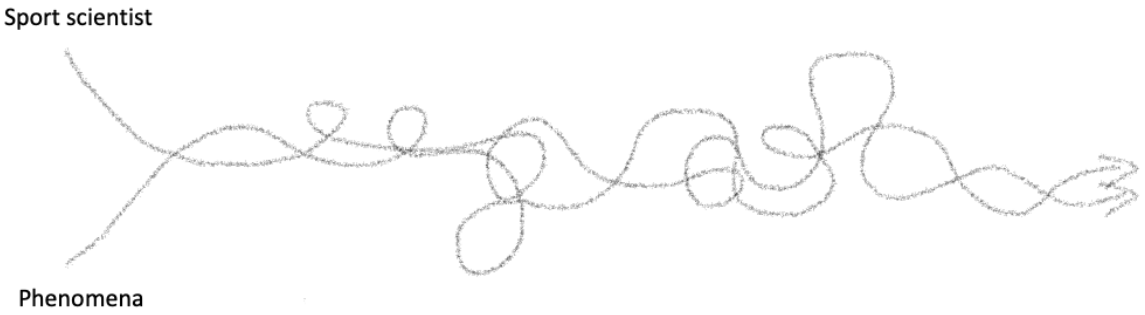
673

Figure 2. Knowledge about phenomena, analysed as objects, connected up in a multidisciplinary network



Note, the connected heavy black lines represent a multidisciplinary team of sport scientists. Each dot is a zoomed-out perspective of what is shown in Figure 1. The shaded grey line, by contrast, denotes the phenomena studied about. The network is static and enclosed on itself, while the phenomena is dynamic, messy, open and ongoing.

682 **Figure 3.** Sport science as art of inquiry, leading to knowledge growth through correspondence



683

684 *Note*, correspondence is messy and entangling, as both the sport scientist and phenomena are, in our
685 account, *things*. This means that the relation established through correspondence is not an interaction
686 of objects, but a *joining together of things becoming*.

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