

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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14

15 **Abstract**

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

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

37 Art does not reproduce the visible but makes visible

38 – Paul Klee, *Creative Credo*

39 **Prologue: On writing a paper**

40 We (the authors of this paper) often discuss the various ways in which we write our research articles.

41 Indeed, while it is a highly individualised process that is far from formulaic, a common thread to which

42 we both resonate is that, to us, writing a paper often feels like we are *making something*. This means

43 we share a sense of artisanship when writing a paper – in a similar way to what we imagine a potter

44 feels while throwing clay to shape a vase, or a dress maker feels while knitting threads to make a

45 garment. The process of making to which we both resonate is not one which sees us having a fully

46 mapped out route to be followed, like the paper somehow exists as a completely-formed entity in our

47 minds, simply waiting to be passively ‘written up’. Rather, it is a process of making which sees us

48 actively feel our way forward, carefully attending and selectively responding to invitations that open

49 up as we weave together a larger, continually (re)forming, meshwork of inquiries. In other words, the

50 paper is not a (pre)determined ‘object’ waiting to be mechanically (re)produced, but is a determining

51 ‘thing’ that actively emerges as we *find our way along*.

52 This process leads to a deeply temporalized thinking; thinking that does not occur separate to the act

53 of writing the paper, but that carries on *through* it. For example, while indeed we have a direction of

54 travel when writing a paper – a large-scale invitation to act that we continually stretch toward – there

55 exists no fixed steps to take, nor formed destinations waiting to be reached. Rather, we are selectively

56 responsive to smaller-scaled invitations, by way of words and sentences that, when woven together,

57 constrain our larger-scaled direction of travel. This means we are able to maintain a grip on the paper

58 in its unfolding, anticipating its future direction, while not losing touch on the immediacy of where we

59 are. Our anticipation, however, is not a prediction of what the paper will look like once ‘finished’, but

60 is a way of helping us look ahead, in the direction we are travelling, so that we can continue to

61 improvise a way forward.

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

67 **Introduction**

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

82 How would an athlete respond if asked to describe athletic performance? Differing to the disciplinary
83 specialists above, they may describe a range of unique, unpredictable, deeply relational and
84 contextual *experiences* (Barker, Barker-Ruchti, Rynne, & Lee, 2012). These would likely be
85 individualised experiences that do not belong to a discipline, and thus risk losing their richness if
86 reduced into pieces, structured into sub-disciplines to be known *about*. After all, “unlike academic

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

95 What does this change in perspective imply for how we – as sport scientists – come to know the
96 phenomena we research and support? Specifically, if the favoured *modus operandi* of research in the
97 sport sciences is founded upon a philosophical paradigm of positivism (see Uehara, Button, Falcous,
98 & Davids, 2014), rooted in the categorisations of the hypothetico-deductive theory of scientific
99 method (i.e., theory-hypothesis-reduce-fit) (Haig, 2018; Woods, Rudd, Araújo, Vaughan, & Davids,
100 2021a), but the inhabited world of athletes is one of primary experience (i.e., relation-context-
101 becoming) (Barker et al., 2012), are we not set upon a path of being perpetually one step behind? Of
102 forever choosing between Scylla or Charybdis – being either too narrow and definitive to be widely
103 applicable, or overly general and abstract such that we miss the very nuances of the phenomena we
104 proclaim to study? If so, how could we reconcile this distinction and step out, beyond the confines of
105 our disciplinary paradigms, and take up with a sport science, not of nouns (i.e., of 'objects' to be
106 classified and categorised), *but of verbs* (i.e., of 'things' becoming and transiting between states,
107 revealing a dynamical ongoing-ness)?

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

111 as on-going 'things'¹, which we can study with and learn from. This distinction is critical for the
112 arguments presented here, as the latter is found upon an ontology which appreciates that *people are*
113 *things who inhabit a world never quite the same from one moment to the next*. The inspiration for
114 these arguments stem from Tim Ingold's (2013) process of making, a notion that sees artisans *think*
115 *through making*, as opposed to *make through thinking*. Where the latter thinks up ideas by way of
116 representations in the mind to then be imposed upon formless matter by a passive body, the former
117 goes *along* with materials in an active participation, corresponding to what such things have to say
118 with a skilled attentiveness and selective responsiveness to improvise a way forward (Ingold, 2011,
119 2013).

120 In what follows, we discuss the implications of these notions for sport science researchers and
121 practitioners. Specifically, we explore how they encourage a progression from the traditional – and at
122 times positivistic and interactionist – hypothetico-deductive theory of scientific method (*making and*
123 *doing through thinking*), toward an *art of inquiry*² (*thinking through making and doing*). To borrow
124 terminology from the ecological psychologist James Gibson (1966), where the former focuses on
125 categorisation and classification – a science of nouns that produces *knowledge about* objects, the
126 latter focuses on improvisation and participation with – a science of verbs that grows *knowledge of*
127 things. This corresponsive approach to research in the sport sciences, practised as an art of inquiry,
128 opens the door for researchers to be responsive to a plurality of paradigms and societal ways of being.
129 For example, to help sport scientists learn to study *with* and not just *about*, fields like anthropology
130 can provide important guidance (see Ingold, 2018), leading researchers to (self)discover key relations
131 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). Thus, to know of a 'thing', is to join with it in its becoming – or, in a word, it is 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.

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

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

149 **Making and doing through thinking**

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

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

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

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

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

206 **Different conceptualisations of knowing**

207 One way of distinguishing this conceptualisation of knowledge is based on what Gibson (1966, 1979)
208 referred to as knowledge *of* and knowledge *about* the environment. The latter is understood as
209 mediated information by way of words, data, pictures and symbols: indirect information that has been
210 produced and documented by another human individual (Gibson, 1966, p. 91; also see Reed, 1996b,
211 ch. 1). The former, by contrast, is direct and unmediated information that is omnipresent in the
212 environment, available to be directly picked up and acted upon by an attentive perceiver (Gibson,
213 1966, 1979). It is the patterned structure of the invariant features of this information which directly
214 specifies *invitations* to act within an environment (Withagen, do Poel, Araújo, & Pepping, 2012) – that
215 is, its *affordances* (Gibson, 1979). This distinction is most apparent in the differences between knowing
216 *about* a sporting landscape, by reading facts and data noted by another person (perhaps documented
217 and depicted in a coaching manual), and knowing *of* the landscape’s invitations to act by way of
218 engaging directly with (i.e., *attuning to*) its sounds, textures, sights, and smells (Woods & Davids,
219 2021). Indeed, both types of knowledge may be used in supporting human behaviour. But our concern
220 here is that the predominant method of inquiry within the sport sciences has been built upon a
221 foundation of the former source, where phenomena are only known *about* by way of second-hand
222 information extracted through the hypothetico-deductive theory of scientific method (Haig, 2018).
223 Sport scientists, in this sense, could be understood as ‘occupants’ who mediate – by way of disciplinary
224 convention, theory, method and concept – their interactions with the phenomena they study about.
225 No more is this apparent than in mainstream publications and editorials that proclaim ‘data is power’
226 for sport scientists (see Nimphius & Jordan, 2020). The word ‘data’, after all, is the plural of the Latin
227 word ‘datum’, roughly meaning ‘to give’ – a *static representation* of the thing which it has been taken
228 to be analysed as an object of ‘fact’ (Rosenberg, 2013). While perhaps well intentioned, editorial
229 statements like the aforementioned, in our opinion, risk keeping sport science within its overly
230 narrow, mechanical and determinable worldview, trivialising direct and primary experience – perhaps
231 even demoted as being ‘merely subjective’ – in favour of a ‘realer’, more quantifiable, ‘objective truth’
232 (Abram, 1997; also see Sparkes & Smith, 2014 for critique). This, we argue next, risks leading to the

233 production, consumption and regurgitation of knowledge about phenomena, generated through a
234 type of hylomorphic vertical integration. Knowledge, parcelled in this way, risks over-compliance,
235 being connected up, documented and labelled in categories and systems of classification.

236 *Vertical integration of knowledge production*

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

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

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

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

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

260 In the sport sciences, and in other heavily positivist disciplines (see Costanza, 2003), vertical
261 integration has led to a fixation on *analysis* (i.e., reduce and deconstruct to produce knowledge about)
262 at the expense of *synthesis* (i.e., observe the entangled becomings of things to know of) (Davids &
263 Araújo, 2010). Why this is a concern, is that it risks leading us away from the phenomena by creating
264 *organismic asymmetries* in research and practice, where the ‘internal mechanics’ of the athlete are
265 viewed as somehow separated or detached from the ecology of relations in which they emerge – that
266 is, the context of behaviours (Davids & Araújo, 2010). Moreover, this fixation on analysis can lead
267 researchers to view phenomena, like athletic performance, not as ongoing things on the cusp of
268 becoming, temporally stretched in-between dynamic states, but as objects that are fixed and static
269 waiting to be split up, categorised into pieces by way of analytics; explained away by being placed into
270 disciplines or sub-disciplinary frameworks. To us, this is *unsustainable* – closing paths of travel rather
271 than opening them³ – and is why inter- and multi-disciplinarity within the sport sciences, albeit a
272 welcomed shift toward collaborative research, can still be limiting (cf. Songca, 2007). Specifically, while
273 a team of researchers, each bringing their sub-disciplinary speciality, work together to ‘solve’ a
274 complex problem, they each still risk viewing phenomena from their own drone-like perspective of
275 the factual landscape. That is, as objects of analysis to be known about, driven by methods underlined
276 by disciplinary assumptions that prevent investigators from ‘seeing’ phenomena as an ongoing thing
277 on the cusp of becoming (Figure 2).

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

279 This approach is typically manifest by researchers in the sport sciences focusing on data collection, or
280 recorded observations documented after the fact. Such mediated interactions leave little room to

³ We signpost this here, as an exploration of what these propositions could mean for the sustainability of research in the sport sciences could be a fertile direction of travel.

281 carefully *listen* to what the phenomena may have to say, or *see* what it may have to show – to critically
282 understand what the ‘data’ or ‘documented observation’ actually mean through the process of their
283 very becoming. This is because phenomena – like athletic performance – are viewed deterministically,
284 composed of objects (i.e., techniques, performance variables, manoeuvres, set plays, tactical
285 formations) with cause (input) and effects (output), explained (hylomorphically) by way of
286 classification into a disciplinary framework (see Morin, 2008). In other words, through “processes of
287 making appear swallowed up in objects made” (Ingold, 2013, p. 7). Thus, by taking up with a sense of
288 artisanship, our proposal is that we, as sport scientists, can refocus our attention toward phenomena,
289 viewed not as objects and nouns, *but as things and verbs*. This approach transitions research that
290 ‘produces and consumes’ knowledge (*about*) by way of making and doing through thinking, toward
291 one that ‘grows and develops’ knowing (*of*) by way of *thinking through making and doing*.

292 **Thinking through making and doing**

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

307 between an athlete's skilled attentiveness and the ebbs and flows of the environment they are a part
308 of. Knowledge, in this sense, is not produced through vertical integration, but *grown along sentient*
309 *lines of correspondence* (Ingold, 2011, 2013).

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

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

323 **Sport science practised as an art of inquiry**

324 According to Ingold (2013, ch. 1), to practise an art of inquiry is not to describe and document what it
325 is that holds our attention, but is to open ourselves to its *goings on* so that we can learn to correspond
326 with what it has to say⁴. This perspective helps us to attend directly to phenomena in their becoming,
327 not indirectly by way of theory or representation established prior to, thereby flipping the 'theory-
328 before-facts' conventions of the hypothetico-deductive method to a 'facts-before-theory' sequence.
329 Note, this position does not deny the importance of theory, concept or data in coming to know

⁴ By 'it', we mean phenomena – like sport performance.

330 phenomena, but that such things do not determine observations *for us*⁵. Simply, as noted in the
331 excerpt above, it promulgates the view of phenomena not as objects, but as things, and ourselves not
332 as occupants, but as inhabitants. This crucial distinction in anthropology signifies the importance of
333 participant observation and primary experience for sport scientists taking up with a sense of
334 artisanship. By this, though, we do not mean to imply an ethnographic analysis deduced through a
335 theoretical framework, leading to the generation of qualitative data documented ‘after fact’. Rather,
336 it signifies a commitment to participant observation and understanding of primary experience that
337 supports researchers in *knowing from with-in* (also see Ingold, 2013, ch. 1). It is this situatedness, after
338 all, that philosopher John Dewey, in this masterpiece *Art as Experience*, argued was central to one’s
339 understanding:

340 “In order to *understand* the esthetic in its ultimate and approved forms, one must begin with it *in*
341 *the raw*; in the events and scenes that hold the attentive eye and ear of man, arousing his interest
342 and affording him enjoyment as he looks and listens” (1934/1980, p. 4/5, emphasis in original
343 and added)

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

347 This idea leads to an important contention for our propositions, in that they should not be read as a
348 simple plea for more qualitative research (e.g., ethnography) within the sport sciences (in which Sport,
349 Education and Society has a long and esteemed history in publishing). Rather, they should be seen to

⁵ 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 *observed* that 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 experimentally 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.

350 argue for more *anthropological* research within the sport sciences. The difference is not vacuous, and
351 requires brief discussion. Notably, both Ingold (see 2013, ch. 1; 2018, ch. 4) and Woods and Davids
352 (2021) argue that the former, ethnography, is *documentational*, describing what one is observing as a
353 by-stander, perhaps even occupying a *drone-like* perspective relative to the phenomena one seeks to
354 know (about). After all, what the word ethnography literally *means* is a ‘description of people’ –
355 *ethnos*: ‘people’; *graphia*: ‘description’. Comparatively, anthropology is *transformative*, seeking to
356 study with and learn from people through an active participation. This, in the words of James Gibson
357 (1979), would be to undergo an *education of attention* to the everyday goings on of the things we seek
358 to know. In sport science, such an anthropological appreciation to research would see scientists deeply
359 embedded *with-in* a sports organisation, learning to progressively resonate with its rhythms by
360 spending months or even years corresponding with coaches, athletes and other stakeholders, as they
361 improvise a way forward, together.

362 What we are advocating here is, in effect, to practise the two-century old Goethean approach to
363 science – a science that commits itself to doing away with explanations and classifications of
364 phenomena-as-objects, known about through means of reduction and reification (*making and doing*
365 *through thinking*), instead entering into a *conversation* (or correspondence) with phenomena in its
366 becoming. Such a corresponsive approach opens up new ways of knowing – leading us to ask of
367 ourselves, not “how can I find ways of adapting the phenomena to my specific approach so that I can
368 answer my question?”, but “*how can I make myself into a better, more transparent instrument of*
369 *knowing?*” (Holdrege, 2005, p. 31, our emphasis)⁶. This perspective threads us neatly back to the
370 practicality of our propositions, supported by the earlier accounts of Portus (2019) outlined in our
371 introduction. Specifically, by viewing research within the sport sciences as an art of inquiry, thereby
372 engaging in participant observation, sport scientists can develop with coaches, athletes and other
373 stakeholders in a corresponsive, blurred, entangled, and *transdisciplinary* way (which is perhaps what

⁶ 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*.

374 Portus (2019) meant when referring to the need for a ‘vibrant ecosystem’). This development in sport
375 science is not forged through a rigid, hypothesis-driven question developed ex-situ and retrofitted to
376 a specific performance context. Rather is created by a *delicate hope* of finding a way to carry on, in a
377 unique direction, together; growing knowledge *of* and *with* phenomena in contexts of practice and
378 performance. Note, such propositions do not diminish the importance of experimentation. Rather,
379 when practised as an art of inquiry, experimentation is not just about proving or disproving
380 hypotheses developed in advance, tested in de-contextualised settings, but is about *giving things a go*
381 – watching, listening, and feeling to how things respond in place – not to know more, but to help us
382 *know better*.

383 We have elaborated, at length, on the potential value of transdisciplinarity for the sport sciences
384 elsewhere (see Woods et al., 2021a), but here, it is important to briefly re-visit four dimensions of
385 transdisciplinary research as outlined by Alfonso Montuori (2013) given their practical alignment with
386 Ingold’s (2013) art of inquiry. First, transdisciplinarity is inquiry-based, not disciplinary-based. This
387 means that research questions should emerge, not just from (pre)formed ideas or disciplinary
388 concepts developed ex-situ, but through continued correspondence *with* phenomenon that has
389 caught our attention, leading one to (self)discover what it has to say. Montuori (2008) suggests that
390 because of the deeply personal interest which drives transdisciplinary research, this approach pushes
391 against ‘reproductive education’ – where an established body of knowledge is consumed and
392 reproduced in order to comply with established tenets of a defined disciplinary framework or concept
393 (perhaps intended to ‘fill gaps within the literature’). Thus, given the sense of misfit and nomadism
394 associated with this first dimension, the sport science researcher practising an art of inquiry could be
395 understood, not just as an artisan, but also as a *perpetual traveller*⁷ who weaves together pertinent
396 lines of inquiry as they go:

⁷ We borrow this phrase from Woods et al. (2021a).

397 “Inquiry means exploration and feeling alive, it means welcoming the mystery of life, not in order
398 to control it but to more fully *participate* in it [...] The more you inquire, the more the world is a
399 source of wonder [...] in the sense that every new advance probably exposes more new
400 *unknowns*.” (Montuori, 2008, p. 17, paraphrased)

401 Second, transdisciplinarity adopts a complex systems perspective, which counters the traditional,
402 reductionist, interactional and internalised notion of *making through thinking*. Moreover, this
403 perspective encourages researchers to view phenomena as things (not objects) – that is, as *places of*
404 *entanglement*. This implication has profound meaning for researchers in the sport sciences, as it
405 emphasises that to know of phenomena is to be able to correspond with its story of becoming, moving
406 along with its direction of travel (Figure 3). For it is along these places of correspondence where stories
407 are bound together in relation, leading to knowledge growth (Ingold, 2011). Thus, *to know a*
408 *phenomenon, is to know its story*. Perhaps, then, sport scientists practising an art of inquiry could see
409 their research as a way of storytelling, going along with the messiness of the lived-in world by
410 transcending passive descriptions about it – manifest in data and ‘hard facts’⁸. A brief note regarding
411 our use of the word ‘relation’: we mean it not as an interaction between complete and bounded
412 entities as objects, but as a (re)tracing of the primary experiences of things (Ingold, 2011). From this
413 perspective, ‘to relate’ is transactional, joining with the stories of others.

414 For a sport science practised as an art of inquiry, tools and measures from complexity science and
415 dynamical systems theory could help researchers formalise a phenomenon’s entangled story of
416 becoming. To exemplify, in a team game like football, the cluster-phase method could be used to
417 understand the synchrony of player movements – both as a whole team and between individuals
418 within a team – as a function of time, ball possession and field direction (Duarte et al., 2013). Further,
419 various social network analyses could be used to resolve path-dependent passing behaviours by

⁸ 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*.

420 adopting measures such as centrality (Passos, Araújo, & Volossovitch, 2016). The point here is: sport
421 science practised as an art of inquiry can help researchers move from the collection of isolated,
422 reduced and static performance variables, captured ‘after fact’ (noun-based sport science), toward
423 the measurement of deeply-contextualised behaviours emerging in real-time (verb-based sport
424 science)⁹.

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

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

431 “But science as it stands rests upon an impossible foundation, for in order to turn the world into
432 an *object* of concern, it has to place itself above and beyond the very world it claims to understand.
433 The conditions that enable scientists to know, at least according to *official protocols*, are such as
434 to make it impossible for scientists to *be* in the very world of which they seek knowledge.” (Ingold,
435 2011, p. 75, emphasis added and in original)

436 By engaging in participant observation, researchers in the sport sciences can remain ‘in touch’ with a
437 phenomenon, situated in its field of relations (for a recent example of this, see O’Sullivan, Vaughan,
438 Rumbold, & Davids, 2021). This proximity leads to a deep and storied understanding, as the researcher
439 is not just passively documenting events – leading to the production of knowledge about – but is
440 actively transforming *with* what they directly experience and discover for themselves – growing
441 knowledge of. To revisit the earlier mention of Goethe, how could one maintain a conversation with

⁹ While a detailed 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.

442 what has caught their attention, if they are forever hovering above events in order to be ‘objective’?
443 For by trying to remove oneself, we argue, would be to perpetuate the very dualism that underlines
444 *making and doing through thinking*. Though, this proposition should not be confused as lessening the
445 importance of searching for truth within a sport science practised as an art of inquiry. Rather, the
446 pursuit of ‘objectivity’ and the pursuit of ‘truth’ should not be conflated as being one and the same –
447 for where the former is detached from the world, the latter participates deeply with it. The pursuit for
448 truth, then, is an ongoing, sustainable practise of *curiosity* and *care* – a curiosity that compels one to
449 *re-search*, and a care that sees one concerned about getting the right things, right (Ingold, 2018;
450 Rietveld, 2008, p. 468).

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

468 the mind of the researcher. An umbrella plan, then, is stretched across the entirety of the organisation
469 in relation to the sport scientist's attentive and responsive participation with the ebbs and flows of
470 the everyday goings on. This means that contrary to popular belief, to anticipate where one is going,
471 it is not a requisite to log or plan out every step in-advance – nor even to have a determined 'end' in
472 sight – so long as one maintains a selective openness to the available invitations to act, enabling them
473 to *carry on* (Ingold, 2013; van Dijk & Rietveld, 2018). In other words, an umbrella plan – in sport science
474 practised as an art of inquiry – provides intentionality, which does not determine the research but
475 *guides its determining, shaped by the embodied, skilled attentiveness and responsiveness of the*
476 *researcher to the ebbs and flows of place.*

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

489 **Conclusion**

490 By advocating for sport science as an art of inquiry, we sought to refocus attention toward the
491 phenomena in context, thereby challenging some traditional conventions of sport science founded
492 upon the hypothetico-deductive theory of scientific method, which advocates reduction,

493 fragmentation and classification. Through a notion of artisanship, we argued for sport scientists to
494 *think through making and doing* (emphasising a verb-based approach), as opposed to *make and do*
495 *through thinking* (demoting the current noun-based dominance). Where the latter integrates
496 knowledge-as-production by way of verticality, the former grows knowledge through correspondence,
497 joining with the stories of things in their becoming, carefully attending and responding to what such
498 things have to say, and where such things have to lead. This makes sport science practised as an art
499 of inquiry, both *wonderous* and *wandering* – unbound by conventional ways of doing or being.
500 Because of this, it is humble, rooted in its ontological commitment that we – as sport scientists – *are*
501 *also things, who have as much to learn from the phenomena we study, as the phenomena from us.*
502 This is why sport science practised as an art of inquiry is transformative, *in-among*, rather than
503 documentary, *out-above*.

504 In following key ideas advocated by van Dijk and Rietveld (2018) and Ingold (2013), we argued that
505 researchers in sport science practising an art of inquiry are indeed able to maintain a grip on the
506 immediacy of the goings on of things, while concurrently looking ahead to improvise a way forward.
507 This means that sport scientists do not need to plan every step out in advance, nor do they require
508 fixed end-points or destinations. In fact, the mere suggestion of such would go against its very
509 ontological commitment. This proposition draws into question the inherent determinacy of traditional
510 systemic conventions of training within the sport sciences, like that of doctoral candidates who are
511 often required to present a proposal of research covering three or more years of study within only six
512 months of enrolment. Such determinate planning risks leaving little room for attending and selectively
513 responding to what phenomena may have to say – *to correspond with its story of becoming* – leading
514 to an inadvertent hylomorphism. This is because, to us, sport science is founded upon an oft-
515 unchallenged separation of knowledge from the processes of knowing; viewing phenomena as objects
516 of analysis, not as things of synthesis temporally suspended in movement. What this can risk leading
517 to is a view of sport science as one of determinable rule following, which fails to appreciate the skill
518 of the researcher. For as philosopher of science Joseph Rouse (1987) suggests, “science is first and

519 foremost knowing one's way about in the laboratory (or clinic, field site)" – implying that it is the craft
520 (or dare we say, *artisansh*) of the scientist which leads to (re)discovery, not abstract universals or
521 passive rule following. Thus, it is our belief that by bringing together knowledge with its process of
522 growth, thereby appreciating the skilled artisanship of researchers, sport scientists practicing an art
523 of inquiry can progress the field forward, into places not determined, but *determining as they go*.

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

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

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

544 to the paper. But it was rather spread across, and constrained by, the many conversations, emails,
545 books, drafts, sketches, notes, reviewer and editor comments and suggestions, and numerous places
546 in which we walked and jogged while attending and selectively responding to our paper's direction of
547 travel. That is, it was stretched across the various timescales of the paper's becoming, within its
548 manifold relations.

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

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

566 “To write is to carve a new path through a terrain of the imagination, or to point out new features
567 on a familiar route. To read is to travel through the terrain with the author as the guide – a guide

568 one may not always agree with, but one who can at least be counted upon to take one
569 somewhere.”

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671

672 **Figure 1.** The vertical integration of knowledge production as *making through thinking*

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

676

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

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

683

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

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