Practicing acroyoga in the space of possibilities: Complexity profile as a heuristic device in sport and exercise research

Practicing Acroyoga in the Space of Possibilities: Complexity Profile as a Heuristic Device in Sport and Exercise Research

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Abstract

This article explores the application of complexity science in sports and exercise research, introducing Ashby's law of requisite variety, Boisot's and McKelvey's law of requisite complexity, and Bar-Yam's complexity profile. These frameworks emphasize the role of complexity in system functionality and shed light on the delicate balance between complexity and scale. Utilizing acroyoga as a novel research context, an interpretivist study was conducted to delve into the activity's complexity profile, revealing the intricate interplay between fostering creativity and maintaining essential regulations. Examining acroyoga practitioners' and influencers' perspectives through the complexity profile underscores the sport's complexity over scale, offering diverse physical, cognitive, affective, and social benefits. However, the limited emphasis on scaling might confine acroyoga to the fringes, hindering widespread acceptance. This study demonstrates the complexity profile as a heuristic tool, challenging assumptions and encouraging innovative perspectives. Acroyoga serves as a compelling case study, highlighting the complexity-scale balance and paving the way for further exploration and sports-related policy formulation.

Keywords

complexity; variety; sport; physical exercise; acroyoga

1. Introduction

Complexity science is increasingly applied as a theoretical framework in sports and exercise research. Studies have explored issues including how the characteristics of complexity appear in different sports (e.g., García-Manso et al., 2008; Ramos-Villagrasa et al., 2012; Corrêa et al., 2012; Berber et al., 2020; Salmon & McLean, 2020), how engaging with notions of complexity might enhance coaching and physical education (e.g., Bowes & Jones, 2006; Jess et al., 2011; Pol et al., 2020), how task complexity affects the performance or learning of athletes (Gabbett & Abernethy, 2012; Laguna, 2008), and how a complex systems approach could be applied in sports injury research (e.g., Hulme et al., 2019; Yung et al., 2022). Complexity science is seen in these studies as a paradigm shift emphasizing holism rather than reductionism (Salmon & McLean, 2020).

The focus of previous research in sports science has typically focused on examining individual elements in isolation, such as training optimization (Freitas et al., 2019) or perception-action coupling (Klostermann et al., 2017), and their effect on the performance of teams and athletes (e.g., Deutsch & Lloyd, 2008). However, understanding complexity as a wider phenomenon has also been recognized. For example, Seifert et al. (2017) highlighted the importance of understanding athletes and sports teams as complex adaptive systems that have properties including non-linearity and non-proportionality (see also Salmon & McLean, 2020). According to Berber et al. (2020), methods for analyzing complex systems have become increasingly popular as an effective framework for understanding and improving athletic performance (e.g., a sociotechnical systems approach to sport-related concussion, see Clacy et al., 2017).

This article contributes to this growing field of complexity research by way of three value-adding factors. First, it introduces Ashby's (1968) law of requisite *variety*, Boisot's and McKelvey's (2011) law of requisite *complexity*, and Bar-Yam's (2002) complexity profile into sport and exercise research. While the laws of requisite variety and complexity direct attention to the importance of variety/complexity for the functioning of the actor/system, the complexity profile provides insights into the tradeoffs between the actor's/system's complexity and scale. Bar-Yam (2018) reflected on this tradeoff in his thought piece on the complexity and scale of various types of physical exercise. This article complements that reflection in a novel research context. Accordingly, the second value-adding factor arises from utilizing the complexity profile in examining one specific form of exercise, acroyoga. Acroyoga is a partner-based form of exercise combining the physical poses of yoga with acrobatics and Thai yoga massage. We believe that, to date, only one peer-reviewed scientific article (in English) has focused on acroyoga (see Struhár et al., 2019). Basic information on the practice is

available through non-fiction sports sources (see Nemer, 2022). We believe that a combination sport like acroyoga provides an interesting context for examining the complexity of sport and physical exercise.

We align with the perspective presented by Lagaert and Roose (2016) that the concept of sport is inherently ambiguous, with unclear boundaries. Defining acroyoga as a sport is therefore contentious, and the outcome depends on the definer of the concept (cf., Krein 2015; Parry 2023). Without delving deeper into the conceptual definition of sport, we observe that acroyoga, as a form of physical activity, operates at the very least on the fringes of sports, akin to non-competitive sport practices such as aikido (see e.g., Kohn 2003). Participants in acroyoga thus engage in physically demanding movements, utilizing specific techniques unique to each activity, requiring various levels of fitness and technical skills, and enabling participants to improve their abilities through dedicated practice.

The third value-adding factor stems from the article's methodological choices. Studies of complexity in sports and exercise have made little use of social sciences, particularly qualitative research methodology (Lebed & Bar-Eli, 2013). Our data are drawn from a survey of acroyoga practitioners (n = 104) containing both qualitative and quantitative questions. This article employs an interpretivist paradigmatic stance and uses the qualitative sections of the survey, that is, 576 comments written by the respondents. In addition, we interviewed acroyoga influencers (n = 8). By analyzing this qualitative data, we aim to answer two research questions: *1) what is the complexity profile of acroyoga,* and *2) how does the complexity profile fit into the context of sports and exercise?*

The article is structured as follows. The article begins by discussing the laws of requisite variety and complexity. These serve as a basis for deepening understanding of the complexity profile. Thereafter, the data and methods are described in more detail before the study analyzes the perspectives of acroyoga practitioners and influencers. Finally, a discussion section binds these results to the article's theoretical framework before presenting the conclusions.

2. Outlining the Complexity Profile

2.1. Laws of requisite variety and complexity

Cybernetician W. Ross Ashby originally formulated the law of requisite variety (see Goldstein, 2011). The central tenet of the law is often summed up in the statement that "only variety can destroy variety" (Ashby, 1968, p. 135). The statement implies that when the system encounters external disturbances,

it should have sufficient means to respond to them; that is, if there are ten different disturbances, the system should have enough variety to respond to each. Correspondingly, if the variety of disturbances exceeds the variety of system responses, the result will be negative effects on the system's vitality.

The law of requisite variety is illustrated in the literature through various practical examples. Gershenson (2015), for example, illustrates that if an industrial robot is required to be able to install four different types of screws, it should be programmed with enough variety to detect the type of each screw and act accordingly. Page (2010), on the other hand, illustrates the issue by using the example of raising a child. While babies produce a limited number of disturbances (e.g., hungry, wet, sick) that require certain kinds of responses (e.g., feed, change, take to the doctor), in the case of teenagers, the number of produced disturbances (e.g., heartache, bullying) and thus the required variety of responses, can be significantly higher. Ashby (1958, p. 409) himself used sport as an example, the sport in question being fencing: "… if a fencer faces an opponent who has various modes of attack available, the fencer must be provided with at least an equal number of modes of defense if the outcome is to have the single value: attack parried."

Boisot and McKelvey (2011) recast the law of requisite variety as the law of requisite complexity. The understanding of complexity was still sparse when Ashby originally formed his law, as the study of complex systems developed more strongly from the 1980s onward. Boisot and McKelvey aimed to develop the law further by incorporating the novel insights generated by complexity sciences. According to this new formulation, "to be efficaciously adaptive, the internal complexity of a system must match the external complexity it confronts" (Boisot & McKelvey, 2011, p. 279). The law of requisite complexity can thus be considered a more dynamic formulation of the law of requisite variety, where the role of adaptation is emphasized—the system strives to challenge its existing assumptions and expand its adaptive frontier to (at least) match the rate at which system's external complexity increases (Boisot & McKelvey, 2011; Chester & Allenby, 2022).

Both laws have been challenged. First, the law of requisite variety has been criticized for lacking empirical research, remaining mostly as "a metaphor without practical operationalization" (Bertoni et al., 2022, p. 1). Secondly, there is no certainty in external variety/complexity, making it inherently immeasurable. The issue challenges the idea that increasing the variety/complexity within the system can be achieved through some kind of mechanical action where internal variety/complexity is matched with *explicit* external variety/complexity (Chester & Allenby, 2022). Third, scholars claim that "agency matters in complexity" (Poulis & Poulis, 2016, p. 518; see also De Toni & De Zan,

2016). The claim calls into question the determinism of the environment; that is, instead of just passively accepting the external complexity and adapting to it, actors may also make a conscious decision to *amplify* the internal complexity (to create disruption in the external environment) or *disregard* it (when complexity is perceived to be too advanced to be dealt with efficiently). In addition, it should be noted that in certain situations, it may be more appropriate to try to alter the complexity of the environment than to adapt to it (Gershenson, 2015).

2.2. Complexity profile

Bar-Yam (2002; 2004; 2015) developed the law of requisite variety by drawing attention to the multiscale nature of the environment. The argument is that actors/systems are not exposed to stressors and complexity on only one scale but on multiple scales that must be managed. The argument highlights a tradeoff between the actor's/system's complexity and scale, where *complexity* refers to (small) independent components and the variety of possible actions. In contrast, *scale* refers to large components and a high degree of coordination (Bar-Yam 2004). Bar-Yam (2004; 2015) has illustrated this through the example of military forces where the term large scale would encapsulate such components as naval fleets and tank divisions, while high complexity is encapsulated in parties such as special operations personnel and guerrilla forces.

Fundamentally, the tradeoff between complexity and scale is a tradeoff between adaptability and efficiency (Siegenfeld & Bar-Yam, 2020). Similarly, Uhl-Bien and Arena (2018) use the concepts of exploration and exploitation (see also March, 1991). Adaptability and exploration in this context refer to innovation, learning, and flexibility, while efficiency and exploitation encompass formality, rules, and standardization. The complexity profile offers a way to characterize this interrelatedness between complexity/adaptability/exploration and scale/efficiency/exploitation. Siegenfeld and Bar-Yam (2020, p. 4) convey the situation as follows:

> Due to the tradeoff between complexity and scale, a system with more adaptability will have a complexity profile with greater complexity but predominantly at smaller scales, while a system with more efficiency will have a complexity profile with lower complexity but extending to larger scales. Accordingly, a very efficient system will, due to its necessarily lower complexity, not be as adaptable to unforeseen variations within itself or its environment, while a very adaptable system, designed to handle all sorts of shocks, will necessarily have to sacrifice some larger-scale behaviors.

In the context of sports and exercising, Bar-Yam (2018) connects scale to the repetition of steps (e.g., walking and running) and full-strength pushes and pulls (e.g., deadlift and squat). When it comes to scaling, the goal of walking or running is endurance, while that of lifting weights is developing

strength or size (e.g., hypertrophy). In contrast, complexity is about variety, that is, how many things an athlete can do. The complexity of exercise thus relates to adaptability, which ideally increases the athlete's or the team's diversity/unpredictability potential (see Pol et al., 2020; Balagué et al., 2020). As Bar-Yam (2018, p. 1) states, "if you study one thing, and you are tested on that one thing, you learn to be good at it. If you do a variety of things and something new happens—a new challenge or a different opportunity—you are more likely to perform well." Similarly, Pol et al. (2020, p. 1) describe how "The fittest are not necessarily the strongest or fastest but the most diverse."

Bar-Yam (2018) considers the world of exercise an artificial one where the athlete (or coach) decides what to do, while in the real world, a person must respond to whatever situation arises. As an advantage, "high complexity exercises expand the space of possibilities of what we can do and the confidence that we can do them well" (Bar-Yam, 2018, p. 1). In addition to the choice of exercise (e.g., weightlifting vs. cross-training), it is possible to influence the complexity through the training location (e.g., road vs. trail) and the number of exercisers (e.g., solo vs. accompanied). Accordingly, the more one has to respond to the variations in the terrain or respond to other people, the more complex the exercise. However, while Bar-Yam (2018, p. 1) considers complexity has benefits, he also acknowledges that for some, "simple exercise may be a relief from the high complexity of our world."

3. Data and methods

3.1. Philosophical orientation

The methodological approach employed was that of the interpretivist paradigmatic position (Donnelly, 2000). As the social world is understood as being continually constructed and reinvented by individuals, the focus is on the lived experiences of acroyoga practitioners and influencers and how they interpret their experiences of practicing acroyoga. We acknowledge multiple interpretations are possible owing to ontological relativism and epistemological subjectivism. Thus, although absolute objectivity remains elusive, this study aims to enhance our understanding of the factors influencing the complexity profile of acroyoga. This will be achieved through a relativistic approach to ensuring the qualitative rigor of the research, including methods such as consulting with *critical friends* (Sparkes & Smith, 2014; Cofie et al., 2022).

3.2. Participants

The data were collected through a combination of survey methods and interviews. A total of 112 participants contributed to this study's dataset, with 104 respondents being Finnish acroyoga practitioners who completed the survey, and 8 being influential figures in the Finnish and international acroyoga community who were interviewed. Among the survey respondents, women were overrepresented (n=70). In terms of age group, the 20–34 (n=56) and 35–49 (n=33) brackets stood out among the respondents. None of the responding acroyoga practitioners reported being 60 years old or over. Most respondents stated they practiced acroyoga about once (n=51) or several times (n=30) a week. At the time of the survey, due to the COVID-19 pandemic, acroyoga practice was limited. Respondents were thus asked to indicate their practice frequency before the pandemic. Most respondents described their acroyoga skill level as intermediate (n=58). The majority of respondents had practiced acroyoga for 1–4 years (n=62). The typical practiced role in acroyoga was quite evenly split between the base (n=32) and flyer (n=44), with some respondents practicing both roles equally (n=28). More detailed survey respondent characteristics can be found in Table 1. Among the interviewed acroyoga influencers (e.g., developers or early adapters of the sport), four were Finnish, and four were international. Similarly, four of them were male, and four were female.

Table 1. Summary of survey respondent characteristics.

Participant characteristics	n (%)	Participant characteristics	n (%)
Age		***Training frequency (pre-COVID-19)***	
<20	1 (1)		
20–34	56 (54)	Several times a week	30 (29)
35–49	33 (32)	About once a week	51 (49)
50–59	8 (8)	A couple of times a month	8 (8)
Chose not to disclose	6 (6)	Less frequently	15 (14)
Gender		***Perceived skill level***	
Female	70 (67)	Beginner	19 (18)
Male	24 (23)	Intermediate	58 (56)
Other	3 (3)	Advanced	27 (26)
Chose not to disclose	7 (7)		
Years of acroyoga practice		***Typically practiced role***	
<1	15 (14)	Mostly base	32 (31)
1–4	62 (60)	Mostly flyer	44 (42)
5–	27 (26)	Both roles practiced equally	28 (27)

3.3. Design

In the autumn of 2020, a survey was conducted among acroyoga practitioners. The survey was distributed through Finnish networks and social media channels related to acroyoga. Survey included both qualitative and quantitative questions. The questions addressed the respondents' relationship with acroyoga as a sport and also its positive and negative aspects. The quantitative questions related to various aspects, such as what skills or qualities acroyoga is perceived to develop, what is personally most important to the respondents in acroyoga, and what emotions they have experienced while practicing acroyoga. In the qualitative questions, which, together with the interviews, constitute the

data for this study, respondents were asked about what they find the best in acroyoga, what the practice offers to them, whether acroyoga has transformed them in any way, if they have encountered any uncomfortable or unpleasant experiences in the context of acroyoga, and how they envision the development of the acroyoga community in the future. Some questions also pertained to the then ongoing COVID-19 pandemic and its impact on the acroyoga practice. The qualitative part of the survey produced 576 comments (46 pages of text, Times New Roman 12 point, 1.5 line spacing).

There is little research literature on acroyoga, so interviewing international and Finnish influencers of the sport helped establish the background of the sport. Accordingly, seven semi-structured interviews (e.g., Kallio et al., 2016) were conducted remotely between April and June 2020. One interview session included two interviewees, and the remaining six were with an individual. The interview protocol consisted of four sections: evolution (examining the development of acroyoga in Finland and internationally, changes in acroyoga since its inception, and factors that piqued interviewees' interest in acroyoga), philosophy (exploring the fundamental principles of acroyoga), characteristics (investigating the core themes and objectives of acroyoga, its relationship to other sports, and its classification as a distinct discipline), and the future of acroyoga (exploring interviewees' perspectives on the future evolution of acroyoga practice and community). The average duration of the interviews was 61 minutes. All interviews were transcribed, resulting in 151 pages of text (Times New Roman 12 point, 1.5 line spacing).

We confirm that all subjects in this study provided appropriate informed consent. Participants in the survey were informed of the study's purpose, procedures, and their rights as research subjects. They provided consent by clicking on the survey link and answering the questions. Participants in the interviews were also informed of the study's purpose, procedures, and their rights as research subjects, and provided verbal consent at the beginning of the interview. The survey and interview materials were provided by the second author at the University of Helsinki, where formal permission from a research ethics committee is not required for non-sensitive research materials involving human participants, provided that individual subjects give their own consent to the research.

3.4. Data analysis

The analysis focuses on qualitative data to reflect the interpretivist paradigmatic stance. These data were analyzed with an abductive approach to content analysis that encourages moving back and forth between the inductive and deductive approaches during the analysis process (e.g., Graneheim et al., 2017). Two researchers (the lead and second authors), who were trained in qualitative analysis

techniques, familiarized themselves with the data by reading all the survey comments and transcribed interviews several times, and then coded the material independently. Interpretational differences were discussed, and efforts were made to find common interpretations. After this initial analysis, two other researchers (the third and fourth authors) acted as critical friends (Sparkes & Smith, 2014), encouraging reflection on alternative perspectives and interpretations. The aim was to enhance research reliability through researcher triangulation, preventing any undue emphasis on individual perspectives or the occurrence of obvious interpretation errors. Additionally, to enhance the credibility of our findings and prevent cherry picking, we incorporated authentic anonymized direct quotations (interviewees identified as #1–#8) from our qualitative data. These quotations were meticulously selected based on their relevance to specific research questions and themes. By including diverse voices through these direct citations, we aimed to provide a comprehensive and nuanced portrayal of our results, ensuring the trustworthiness of our study.

In line with qualitative research methodology, the analysis process was iterative, allowing for in-depth exploration of the data. To ensure reliability, our approach followed established guidelines for intercoder reliability in qualitative research (Cofie et al., 2022). The initial phase of the analysis adhered to a deductive approach, drawing upon elements from prior studies, such as those by Bar-Yam (2002; 2004; 2015), to create an initial coding framework. This deductive-oriented approach led to the identification of first-level categories—*complexity* and *scale*—which form the foundation of a complexity profile framework. *Complexity* was further dissected into two distinct second-level categories: *variety* and *adaptation*, while *scale* was divided into *coordination* and *structure*. These categories, informed by our deductive framework, allowed for a comprehensive exploration of the data. As the analysis progressed, an inductive-oriented approach was employed, enabling the emergence of more specific subcategories. For instance, *adaptation* was further nuanced into *adaptation to others*, *adaptation in movement*, and *adaptation to different bodies*. This detailed exploration ensured a nuanced understanding of the intricate aspects of acroyoga practice, enhancing the depth and richness of our findings.

4. Results: Tradeoffs between complexity and scale of acroyoga

4.1. Variety vs. coordination

Two interconnected categories of variety emerged from the data: variety of sports and variety of benefits. The former reflects the interviewees' opinions on the sports activities comprising acroyoga and its essence in general. While the thoughts of the acroyoga influencers were quite aligned on the

sports activities underpinning acroyoga, there were some differences in views on the extent to which acroyoga is its own sport. These divergent views can be considered reductionist and emergent forms (e.g., Hodgson, 2020). According to reductionist views, acroyoga can be broken down into smaller component parts. From that perspective, acroyoga consists of several activities practiced by a certain community. The respondents listed yoga, acrobatics, Thai yoga massage, dance, and circus arts in their answers. One interviewee described this view as follows: "In my opinion, acroyoga is not a sport in itself. I see that acroyoga is really like a community that practices three different sports." (#7) Instead, according to the emergent view, something new is born from the combination of these sports activities, so that as a result, acroyoga is not merely the sum of its parts, and should be considered a unique sport or a form of exercise. This view is reflected in the following quote: "You could view acroyoga like hip hop, right? Hip hop is something that took from so many different genres, took it, mixed it all together and created something new." (#2)

The interviewees also reflected extensively on the differences and similarities between acroyoga and the activities on which it is based. For example, acrobatics was associated with the underlying physical dimension of acroyoga. However, acroyoga was seen as calmer and slower in its movements and less focused on tricks than acrobatics. In addition, unlike partner acrobatics, acroyoga is not practiced with a regular partner. Yoga was seen to contribute "yogic sensibility" and "softer skills" (#3) to the practice of acroyoga. The terms tend to refer to breathing awareness and caring communication. Acroyoga, on the other hand, was considered to add a strong social element to traditional yoga practice. The key perceived difference to circus arts was that acroyoga is not directly related to (public) performance. In addition, Thai yoga massage was connected to the therapeutic side of acroyoga, that is, recovery and body care.

The variety of benefits was described in the qualitative survey data. These benefits can be divided into physical, cognitive, affective and social resources (see Calderwood et al., 2021; Raisio et al., 2021) provided by acroyoga. In terms of physical resources, the data highlighted the development of muscle condition, improved mobility and agility, and overall body awareness. The respondents mentioned how acroyoga had helped them understand the strengths and weaknesses of their bodies, for example. One respondent stated that this physical aspect of acroyoga should be promoted more strongly: "[Acroyoga is a] great sport, but it could perhaps get more practitioners if its physicality were brought out more. Currently, at least in my opinion, the sport falls into the category of 'hippiness'." The provided cognitive resources were associated with answers that mentioned

improving the capacity to concentrate; demanding sequences of movements require acute concentration.

In terms of affective resources, a coherent narrative emerged on how acroyoga presents various positive physical challenges and thus offers experiences of success and surpassing perceived limitations. The respondents felt they had overcome their fears and gained more self-confidence by practicing acroyoga. Acroyoga also seems to have brought a kind of sense of control to their lives, as described by one respondent: "Once, when I was in the middle of a crisis when I was asked, I answered that when I am able to control my body, I get the feeling that I control at least something in my life when you cannot always control life otherwise." Social resources, on the other hand, were related to the experiences of how acroyoga has developed its practitioners' communication skills and reduced anxieties around meeting new people. The respondents emphasized how they had found new friends and a new community through acroyoga. The data also revealed the physical side of sociality: "Touching has become the most natural thing in the world, which it was not before practicing acroyoga."

The element of coordination was visible in the data to only a small extent. It was seen to be more related to the early days of the development of the sport when there were only two schools (Acroyoga Montreal and Acroyoga International), and the role of manuals and standards was stronger. Today, different teachers and schools introduce a wide variety of creative elements, and the sport can no longer be represented in a single manual. The interviewees also described how acroyoga mutates and morphs. One interviewee summarized this as follows: "So I think to say that there is one view of acroyoga is wrong…. It is going to formulate and develop depending on the person and the community doing it." (#2).

4.2. Adaptation vs. structure

Adaptation appeared in three categories: adaptation to others, adaptation in movement, and adaptation to different bodies. The interviewees explained how in acroyoga, movement is co-created, thus requiring adaptation to others. The other person is neither an opponent, as, for example, in martial arts, nor a material object: "[He/she] is another person and not some parallel bar or gymnastic rack." (#5). Respondents pointed out that there are three roles in acroyoga: flyer, base, and spotter, each being important. The respondents stressed the importance of being able to create a connection with another person, being able to understand their body language and trust them. Ideally, practitioners will discover a shared rhythm: "Improvising together, that wonderful feeling with a familiar base,

when words are no longer needed, but both bodies know how to react correctly and in the right directions, to where the flow is taking the movement."

Adaptation in movement was exemplified in the creativity connected to acroyoga practice. In acroyoga, this creativity seems to come out, especially through playfulness, which was widely referred to throughout the data. The playful nature of the sport encouraged people to try new things and be creative. Acroyoga was described as letting out the inner child and encouraging the realization that even as an adult, people can have fun in a good way. One interviewee reflected on this: "There is something about being lifted up in the air, which may have last happened when you were a child" (#7). Freedom and creativity of movement were particularly associated with acroyoga jams—open practice sessions with less structure, which often take place in a different environment from the usual classes, such as a park.

Adaptation to different bodies emerged from how the respondents mentioned the possibility of practicing acroyoga despite perceived physical limitations. Practitioners and the community adapt according to the situation. Accordingly, for example, lacking a limb would not necessarily prevent someone from taking up acroyoga, nor would being overweight or pregnant. The respondents were keen to convey that the base and flyer roles were not necessarily constrained by gender: "…girls/women can be very strong bases, and many positions do not even require a lot of strength—good technique is everything."

The element of the structure was visible through the explicit role differentiation—base, flyer, and spotter—but also guidance, rules, and sports etiquette. Safety is a central theme of acroyoga. Safety encompasses the safety of the movement, preventing injuries, and having a safe space to practice acroyoga. Under that broad interpretation, safety issues would encompass experiences of being pressured into movements that one is not ready for, indifferent/careless spotting, and experiences of harassment and feeling like an outsider (for example, because of a large build). Accordingly, while some survey respondents wished for more self-organizing jamming, others wanted more guided lessons and firmer guidance overall. One respondent even preferred "a more authoritarian culture where the teacher 'gives orders' and the practitioners follow instructions." Enhanced guidance and structure was seen as a safeguard to reduce the risk of injury and increase inclusivity.

One interviewee aptly described the balance between adaptation/creativity and structure/rules as follows: "Yes, I think that [what fascinated me in acroyoga is that] it is a combination of the basic

strict rules like bone stacking and also the possibility for creativity, that you can create your own moves. Sometimes it is just safe to give people a strict position and learn the basics like this is how you carry a person, this is how you make it safe, this is how you do the sparring. And sometimes just give them room to experiment, but that requires some basic techniques." (#4)

5. Discussion

Complexity characteristics have been a subject of investigation in established sports, with football serving as a prime example of such complexity. Salmon and McLean (2020) have posited that football operates as a complex system, where non-linear interactions and emergent properties are evident across various subsystems, including individual matches, clubs, and leagues. On the other hand, when football is examined through the lens of the complexity profile (Bar-Yam 2002; 2004; 2015), it reveals a delicate balance between the complexity and scale of the sport. Despite football being inherently complex, it operates within well-defined structures and regulations. The essence of football is unmistakable, as evidenced by the sport's globally codified rules, which allow minimal national variations. This clear regulatory framework underscores the game's fundamental principles, emphasizing the balance between variety of possible actions (i.e., complexity) and structured gameplay (i.e., scale).

The situation can also be interpreted through Huizinga's (1949) concept of *Homo Ludens*, referring to people who play. For instance, Duncan (2022) argues that modern sports have become increasingly serious, structured, and disciplined, leading to the overshadowing of elements such as fun, freedom, flair, spontaneity, and creativity. Consequently, efficiency and exploitation appear to take precedence over adaptation and exploration. However, Duncan (2022) also provides inspiring examples of reintroducing enjoyment and liberty into the modern professional sports arena. These instances demonstrate that even in the face of stringent regulations and highly organized gameplay, it is feasible to inject a sense of fun and freedom back into football, trading some aspects of scale for the richness of complexity.

Regarding acroyoga, interpreting the perspectives of acroyoga practitioners and influencers through the complexity profile highlights the prominence of the sport's complexity over its scale. Firstly, acroyoga, as exemplified in this study, embodies the spirit of play. The data underscores a prevalent narrative of fun and playfulness, of reconnecting with the inner child, particularly linked to creativity and adaptation. Secondly, the interviews unveiled ambiguity surrounding the essence of acroyoga. While some interviewees regarded acroyoga as a fusion of existing sports (the reductionist view),

others perceived it as an independent sport with distinctive characteristics (the emergent view). This ambiguity is perhaps expected in a sporting activity practiced for only about 20 years, where rules, regulations, and identity are still evolving (e.g., Nemer, 2022). Currently, the breadth of variety (and thus complexity) expands due to individual teachers' diverse sports backgrounds, introducing entirely new elements to acroyoga. For instance, acroyoga might predominantly reflect its yoga roots in one context, resembling acrobatics elsewhere, even being interpreted as a subcategory of it.

This emphasis on complexity has both positive and negative aspects. Ideally, the diversity of sports that form the foundation of acroyoga aligns with the range of benefits associated with it, encompassing various physical, cognitive, affective, and social advantages (see Calderwood et al., 2021; Raisio et al., 2021) provided by multifaceted acroyoga practices. However, the low emphasis on scaling in acroyoga might keep the sport on the fringes, impacting its potential for growth. If the sport were to prioritize scaling, a more uniform, standardized acroyoga might emerge. Yet, there's a risk that acroyoga could lose its fundamental essence, including its perceived "hippiness." A sports activity geared for widespread participation might no longer preserve its original design, tailored for high-complexity interactions on a smaller scale (see Bar-Yam, 2002; 2004; 2015).

The discussion on the role of informal sports in the contemporary context is of particular interest (e.g., Gilchrist & Wheaton, 2017; Säfvenbom et al., 2018; Jeanes et al., 2019). Informal sports, existing outside traditional sports organizations, operate in a realm that is neither strictly organized nor entirely disorganized but rather self-organized. Unlike conventional sports entities (e.g., ice hockey or football clubs) which are typically characterized by scale (i.e., a high degree of coordination), informal sports tend to emphasize complexity (i.e., a high degree of adaptation). However, the institutional dynamics of sports are subject to change. Informal sports, originally loosely structured, may transition into organized environments, leading to increased formalization and regulation, resembling traditional sports clubs (see Borgers et al., 2018). The self-organizing nature of sports is exemplified especially in the informal jam culture of acroyoga.

Informal sports are considered to offer opportunities to reach people who feel excluded from traditional sports organizations, which can appear to them as marginalizing and excluding spaces (Jeanes et al., 2019). Informal sports can thus offer a community, as acroyoga practitioners and influencers describe. An intriguing question emerges: to what extent are individuals who find regulated sports less engaging attracted to informal sports emphasizing complexity over scale? Those disinterested in structured sports with strict rules might be drawn to informal sports where flexibility

and creativity are valued. Informal sports, promoting adaptability and diverse approaches, can appeal to individuals seeking a more personalized and less regulated sporting experience, potentially expanding sports engagement beyond the boundaries of traditional organized sports. However, it is essential to recognize the delicate balance at play here. As highlighted in the data, regulations, guidance, and sports etiquette remain vital. They serve to mitigate risks such as injuries and harassment. Hence, there exists a delicate equilibrium between fostering creativity and freedom and maintaining necessary regulations and structures.

As a conclusion, acroyoga seems to indicate that the complexity profile fits the context of sports and physical exercise, perhaps not as a mathematical and analytical tool, *per se*, but as more of a heuristic device. As a heuristic device (see Schuller, 2000), the complexity profile could challenge existing assumptions, stimulate fresh thinking, and even open avenues for further exploration, such as sports-related policies and initiatives.

The main limitation of this study relates to the potential for generalization. In the survey, only a portion of Finnish acroyoga practitioners were reached, with respondents over 60 years of age notably absent. This raises the question of whether the survey failed to reach older practitioners or if the practice itself is suitable for individuals of all ages (i.e. adaptable to different bodies). Also, the research focuses only on one sport, and consequently, further analysis of the complexity profile would demand extensions to other sports, such as traditional team sports or individual sports, such as powerlifting. The extension could also involve scrutiny of informal sports similar to acroyoga, such as freerunning or tricking. A question which remains is how practitioners of those sports experience the balancing act between complexity and scale. An intriguing avenue for future research would be also to investigate how sports executives perceive the utility of the complexity profile.

6. Conclusions

Sports and exercise research is increasingly scrutinizing complexity. Significant complexity-informed research is already carried out in the field, but it is also important to consider the diversity of methodological choices (see Lebed & Bar-Eli, 2013). Improving the integration of qualitative and quantitative research would ideally enable a better understanding of complex phenomena and extend knowledge bases (e.g., Hendren et al., 2018). The findings of this study illustrate how complexity can be examined and interpreted from a more comprehensive perspective by integrating various complexity constructs, namely, the laws of requisite variety/complexity and complexity profile. The theoretical synergy among these three complexity constructs offers a framework for understanding

and interpreting the constant balancing act between variety and coordination, as well as adaptation and structure. This approach holds potential for application in other research endeavors exploring the complexities of sports and physical exercise phenomena.

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