Complex Basketball Coaching

How to make basketball
practices more effective.

By Harri Mannonen

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FOREWORD

I have met many coaches around the world through my books and coaching travels, but few challenge me to think about coaching and practice like Harri Mannonen. As with many coaching associates, I knew Harri initially through the Internet, but did not meet him until I visited Finland in May of 2018. Over 10 days and numerous clinics and practices, he continually challenged my thinking and beliefs.

Harri applies the pertinent research to coaching better than anyone of whom I am aware. He changed my approach to shooting development with the idea that to be "game-like", a shooting drill must have, at minimum, a defender and a passing option. In this book, he again has combined research that few understand to the practical art of coaching.

Few coaches are concerned with coaching theories. Most coaches coach as they were coached, and many ask few questions of their process, especially if they played for successful coaches or had a successful playing career. Whereas nothing truly replaces coaching experiences, an understanding of the basic coaching paradigms and theories informs one's coaching. In this book, Harri has explained some basic theories of coaching and their shortcomings, and added to our theoretical understanding of coaching as a discipline by framing coaching within systems theory and complexity.

Through the last decade, systems theory and complexity have impacted the way in which we see the world, but this book is the first, to my knowledge, to situate coaching within systems theory.

This sounds academic and theoretical, but Harri manages to add practical value for coaches. This is a rare achievement. From experience, I can attest that writing a book that stands up to scientific and academic rigor, while providing value for coaches, is very difficult. This book succeeds in both respects.

It describes the basic coaching paradigms and explains their shortcomings before providing a more expansive theory for the coaching profession, while providing real examples that coaches can use tomorrow in their practices.

This is an important addition to the coaching literature, and a book that can be used a textbook for coaching principles as well as a resource for coaches looking for new ideas and practical guidance for their teams today.

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Author, The 21st Century Basketball Practice & 21st Century Guide to Individual Skill Development

INTRODUCTION: Welcome, Coach

What kind of a coaching paradigm optimises the effectiveness of basketball practice?

That's the question we'll look into in this book.

There's not going to be one definite answer. That's because so much depends on the context: the age group, the level of players, the rules, and so on. In different contexts different things are effective.

Nevertheless, we'll draft an answer that can be useful in different contexts. Hopefully, the answer – or this book – can serve as your helping hand. However, eventually it's up to you to apply the general teachings to your context.

For more than three decades, I've been thinking about this question. For the first thirty years, the answers were fragmental at best.

That's because there was no underlying methodology. I could not merge the fragmental information into one big picture.

This is a common problem in coaching. That's because relevant information is available from various sources. Sports science really is an interdisciplinary one.

Enter complexity science. Or "a study of emergent system behavior" in complex systems. [Santa Fe Institute no date Complexity] It provided a framework where the fragmental information that I had, began to merge into a coherent big picture of basketball and coaching basketball.

In a way this is no surprise. A basketball team is a complex system, so complexity science should be an appropriate way to analyse its functioning. Sports scientists have done a lot of research like this. [Garcia Rubio et al 2013]

Yet recent research results have caused relatively few changes in practical basketball coaching. The idea of a basketball team as a complex system hasn't been fully utilised. This book will help you do that.

So, our ultimate goals are practical, but first we'll engage in a theoretical discussion. We'll define terms, analyse existing coaching paradigms, and so.

Why bother? Why not move straight into the praxis – the drills and so?

Because we want to have solid ground under our feet.

Theoretical assumptions always underlie coaching. You can deny it but you can't escape it. The assumptions may be explicit or implicit but they will be there.

If the assumptions are not discussed critically, they will not be corrected or developed. This makes it difficult to systematically enhance the effectiveness of coaching.

On the other hand, theoretical musings will not win us games unless we apply them – transform them into real-life basketball practice tasks. And that we will do.

Thanks to Tuomas Iisalo, Felix Lebed, Janne Lehtinen and Brian McCormick who have directly helped to improve this book.

The book that by far has most influenced my thinking relevant here is *Complementary Thinking* by J.A. Scott and David A. Engstøm. [Scott and Engstøm 2006] *The Perception & Action Podcast* by Rob Gray has helped me make sense of current research in sports science. *21st Century Guide to Individual Skill Development* by Brian McCormick was my model on how to put together a book like this. [McCormick 2015]

CHAPTER 1: Complex Systems

1.1 Basketball Team as a Complex System:

Complexity science is "an interdisciplinary field" where the methods are drawn from a variety of fields. [Downey 2018] Since it is not defined by its methods, it's defined by its objects: complex systems. [Davis and Sumara 2005]

So, we can apply complexity science to basketball coaching if – and only if – what we coach is a complex system.

What actually is the entity that we coach when we coach basketball?

In the FIBA rules, article 1.1 says: "The aim of each team is to score in the opponents' basket and to prevent the other team from scoring." [FIBA 2018] So, the entity we coach is the team.

Is a basketball team a complex system? To answer this, we must answer two question.

First, is a basketball team a system?

A system is defined as "an entity of interacting parts functioning as a persistent whole distinguished from the environment by recognizable boundaries". [Lebed 2006]

Given this definition, a basketball team – for example, fictional Alligators – is a system. Its parts or the players interact, and the whole is distinguished from the environment.

Second, is the system of a basketball team a complex one?

For a system to be complex, it must have these additional properties [Poli 2013]:

- It is a part of hierarchies of complex systems. Consequently, in addition to bottom-up causation, there is top-down causation. Changes at the higher scales of the system hierarchy cause changes at the lower scales.
- The interaction of its autonomous parts produces emergence. So, based on the input, one can not exactly know what the output will be.

A basketball team does have these properties. Players are autonomous, and it is impossible to know exactly how the Alligators will play in a game. And there is top-down causation: how the Alligators play as a team affects how its players play.

So, a basketball team is a complex system. That conclusion is not controversial. In the contemporary research, invasion team sports teams are routinely viewed as complex systems. [Garcia Rubio et al 2013]

Besides basketball, invasion team sports include American football, ice hockey, soccer, water polo. In invasion team sports [Mannonen 2014]:

1. There is a playing area of two halves and each team has its own half.
2. Each team defends its own half and attacks the other team's half.
3. Players of both teams occupy common ground.

Even if basketball teams are complex systems, a basketball game is not. That's because it says in the definition that a system is "a persistent whole". And a game is not persistent but quite temporary.

Rather, a game is "a conflict of −−− two complex dynamical systems". [Lebed 2006] That – to be precise – is what we mean when se say that basketball complex.

1.2 Team in a Hierarchy of Complex Systems

Complex systems are nested in other complex systems. Since basketball teams are complex systems, they must be nested. But where?

Perhaps most obviously, a team is a part of the league where it plays. Thus in the hierarchy of complex systems, the team is one scale down from the league.

In turn, the league is a complex system nested in other complex systems – often the competition system of the national basketball federation.

A team is a part of complex systems other than the league, too. For example, it is a part of the club that may have multiple other teams as well. Or if it's a school team, it's a part of the school sports team system.

All entities relevant here are parts of multiple complex systems. So, an Alligator is not just a part of the Alligators but also a part of her immediate family.

Hierarchies of complex systems are a matter of the context. They can be very different for players who are of different age and play on different teams.

Even for the same team different hierarchies can be conducted, depending on what we want to analyse. Table 1 shows one example of such a composition.

League	Club	School	Extended family	Neighbor-hood
Alligator team		Class	Immediate family	
Alligator players				

Table 1: Hierarchy of complex system around the Alligator players.

Table 1 highlights the Alligator team: it is placed at the scale right in the middle. The entities where the team is a part are located at the next scale upwards. The league and the Alligator club are the examples here.

The team's parts – or the players – are shown at the next scale downwards.

1.3 Definitions of Key Terms

In this book, we define key terms. That is because many basketball terms are ambiguous, and we want to be clear. We want to have solid ground under our feet.

Our definitions are written from the viewpoint of complex systems thinking. Viewed from different viewpoints, the entities could be defined differently.

Our definitions serve their purpose if they are comprehensible to you, the readers. Then we can base an intelligent joint discussion on these definitions. If we disagree, we know what we disagree about.

First up: how do we define basketball?

Generally, "a formal definition corresponds to the formula an X is a Y + distinguishing characteristic, where Y is a class word or superordinate term". [Pearson 1998] So, we start by saying that basketball is an invasion team sport.

What then distinguishes basketball from other invasion team sports? In basketball, the basketball rules are followed. Our definition comes to be:

- *"Basketball is an invasion team sport where the conflict between the two teams is confined by the basketball rules."*

Consequently, any invasion team sport can be defined using the same formula:

- *"X is an invasion team sport where the conflict between the two teams is confined by the X rules."*

What then is basketball practice?

Practice has been defined as "repeated exercise in or performance of an activity or skill so as to acquire or maintain proficiency in it". [Lexico no date practice]

In a game, the aim of a basketball team is "to score in the opponents' basket and to prevent the other team from scoring". Eventually, the team aims to have "scored the greater number of points at the end of playing time" and to "be the winner." [FIBA 2018]

In other words, the goal of the teams is to manipulate the conflict so that they beat the other team. To enhance their chances, teams practice.

Given this, we formulate this definition:

- *"Basketball practice is activity that aims to optimise the proficiency of a team at manipulating the conflict in basketball games in their favour."*

In the context of sports, coaching refers to training, instructing, and teaching an individual or a team. [Lexico no date]

So, we may formulate this definition of coaching:

- *"Basketball coaching is activity where a team is trained, instructed, and taught in order to optimise its proficiency at manipulating the conflict in basketball games in their favour."*

A basketball coach can be defined simply as:

- *"Someone who does basketball coaching."*

CHAPTER 2: Coaching Paradigms

2.1 Defining a Coaching Paradigm

We set out to draft the most effective basketball coaching paradigm. Now we have defined coaching but what is a paradigm?

Here we define a paradigm as Thomas Kuhn did: it is a model that includes "key theories and laws" and "the applications of those theories in the solution of important problems". [Bird 2018]

In this book some key terms come from Thomas Kuhn, too. Terms and ideas that he applied to philosophy of science are here applied to basketball coaching.

So, by definition there are theories and laws underlying practical coaching. Sometimes the theories and laws are articulated. But often they are not articulated or even recognised.

There is an explanation: "Coaches often see little value in a philosophy as they attempt to cope with more tangible aspects of coaching practice, such as session content and organisation". [Cushion and Partington 2016]

Coaches may consider their philosophical assumptions so "common-sense", "taken-for-granted" and "normal" that there is no need to articulate, let alone examine them. [Cushion and Partington 2016]

But there can be no solutions without theories that underlie them. In other words, where there is practical coaching, there is also a coaching paradigm – whether the coach acknowledges the paradigm or not. [Puhakainen 1995]

Say the Alligators' Coach Ally runs exclusively constant and blocked shooting drills. Obviously she believes that constant and blocked practice is the most efficient method to learn shooting. The belief is there no matter whether Coach Ally articulates it or recognises it.

So, since we look to optimise the effectiveness of basketball coaching, we must reveal and analyse the prevailing coaching paradigms. Only after we've articulated them, we can discuss them intelligently and assess them critically. [Puhakainen 1995]

For example: Say Coach Ally's belief in constant and blocked practice is not articulated. We are stuck discussing and analysing the pros and cons of individual drills. That's inefficient compared to discussing the principles underlying her coaching.

2.2 Paradigm Shift

What then signals that we need a paradigm shift – that forming a new paradigm might enhance the effectiveness of coaching?

First, we look for contradictions between:
a) The predictions based on the prevailing paradigms, and
b) Research results and possibly anecdotal evidence that arise from common coaching experience.

Contradictions between a) and b) are called anomalies. The term comes from Thomas Kuhn: "Discovery commences with the awareness of anomaly, i.e. with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science." [Kuhn 1962]

In science, the appearance of anomalies does not necessarily mean that the current paradigm is going to be revised. "Rather, anomalies are ignored or explained away if at all possible." [Bird 2018]

The same is true in coaching. Up to a certain point it is rational to stick to the old ways. A few anomalies are not an adequate reason for replacing a paradigm, or a paradigm shift.

That is because in complex systems "the interaction of its autonomous parts produces emergence." There will be anomalies no matter how fitting the paradigm is. So, no coaching paradigm will ever be perfect.

Because of the same thing, there is not going to be one definite point where we can say that the paradigm shift is now inevitable. Rather, the paradigms continuously compete for prevalence with their "puzzle-solving power". [Bird 2018]

2.3 Requisites of a Coaching Paradigm

According to Kuhn, there are five charactetistics that "provide *the* shared basis for a choice of theory". [Bird 2018] Thus we want the complex basketball coaching paradigm CBC to have these characteristics.

1) Accuracy. CBC must be able to explain anomalies that the positivistic and holistic paradigms can't explain. But CBC must also be able to solve all puzzles that the prevailing paradigms can explain.

2) Consistency. CBC must comply "with other currently accepted theories" (Bird 2018], in our case for example complex systems thinking. CBC must also be internally consistent: its claims mustn't contradict each other.

3) Simplicity. Through CBC we must be able to organise "otherwise confused and isolated phenomena". [Bird 2018] In other words, CBC will be used to find patterns in basketball – to make sense of its regularities and irregularities.

4) <u>Scope.</u> CBC must be applicable to future situations, or "beyond the data it is required to explain" now. [Bird 2018] Its true worth can't be assessed immediately. The assessment will go on, as new research results are published.

5) <u>Fruitfulness.</u> CBC must supply scientists with research new topics – and coaches with new coaching puzzles.

With this list of requisites in mind, we'll base the complex coaching paradigm on:
1. The critique and anomalies regarding the positivistic and holistic coaching paradigm. This provides CBC with **accuracy**.
2. Our definitions of basketball, basketball practice, and basketball coaching. This provides CBC with **consistency**.
3. For **simplicitys's** sake, we'll keep CBC as simple and straight-forward as possible.

From Kuhn's list, scope and fruitfulness are left unattended for the time being. Both characteristics are such that they can assessed once the paradigm has been applied.

CHAPTER 3: Prevailing Coaching Paradigms

3.1 Positivistic Coaching Paradigm

Historically, the dominant paradigm in coaching has been the positivistic paradigm. [Puhakainen 1995, Jones and Wallace 2005]

As discussed above, often coaches do not articulate or even recognise the assumptions that underlie their coaching. So, many coaches who the carry out the positivistic coaching paradigm do not acknowledge or even realise that.

Also, even if a coach's general paradigm is positivistic, she may not subscribe to all positivistic claims. And the terms mentioned here have many definitions, so not all forms of positivism are the same.

There are multiple versions of the positivistic coaching paradigm. The names are different:
- Behaviouristic coaching [Roberts and Potrac 2014]
- Reductionistic coaching [Gray et al 2014]
- Scientific coaching [Kiely 2012]
- Tayloristic coaching [Kiely 2012]

Also, the emphases are different, yet the main underlying assumptions are the same. Or at least do not contradictt hose of the other related paradigms. So we deal with all related paradigms put under the label "positivistic coaching".

The underlying philosophical assumptions are listed in the left column of Table 2. The middle column shows general coaching principles, or the "key theories and laws" of the paradigm. [Bird 2018]

The right column shows assumptions common in basketball coaching. In other words, the right column claims are applications of the paradigm's key theories "in the solution of important problems". Kuhnian paradigms must include these applications. [Bird 2018]

Underlying philosophical assumption and its source	Assumption applied to the basketball context	An every-day example of the assumption applied
Positivism: Theories are universal. The same principles "can describe human behavior and phenomena across individuals and settings". [Kim 2003]	There is an optimal technique for each task in basketball, and every player should use the similar technique.	"The thumb of the shooting hand should be spread to about a 60-degree angle to index finger." [St. Martin 1992]
Behaviorism: Emphasis is put "on mastering early steps before progressing to more complex levels of performance." . [Ertmer and Newby 1993]	Basketball is best learned in a linear fashion – gradually and systematically moving upwards in the hierarchy of skills, from simple to more complicated ones.	"The most critical part of the game" is to "present a systematized method by which maximal skill development may take place in the game of basketball." [Hankinson 1980]
Reductionism: The functioning of a system can be explained and predicted through the functioning of its parts. [Ney no date]	The effectiveness of a player correlates linearly with her relevant anthropometric and physical characteristics.	"His strength is in his shooting touch, but as he builds muscle, [Lauri] Markkanen will be nearly unstoppable to defend - - -." [Gilmore 2018]
Scientism: There are absolute laws in human sciences, like there are in natural sciences. [Martin no date]	There are optimal tactical decisions that always benefit a basketball team.	"Teams have realized that they can improve their offense by simply changing their shot selection. Take more threes and score more points." [Shea 2018]
Taylorism: To make learning more efficient, skills are broken down into simpler skills. [Deubel 2003]	Jump shooting in games can be improved through improving jump shooting without defense in practices.	"You can practice and improve your shooting by yourself, but it takes patience and dedication. Once you understand the mechanics, you will only need a ball and a basket," [Chance 2018]

Table 2: Underlying assumptions of the positivistic coaching paradigm

3.2 Holistic Coaching Paradigm

The positivistic coaching paradigm has been challenged by the holistic paradigm. There the promary object of coaching is an individual player. [Puhakainen 1995]

Holistic coaching is related to athlete-centered coaching and humanistic coaching. [Cassidy 2010] Even though the terms are not synonyms, they share the two key theories we'll discuss. [Kidman 2010]

First, according to the holistic coaching paradigm a player should be coached as a whole. That is, everything about her is to be considered: "emotional, political, social, spiritual and cultural aspects, in addition to mental and physical ones." [Jones and Turner 2007]

Secondly, coaching is viewed "as a complex social process, which involves a myriad of interacting variables". [Jones and Turner 2007]

Thus the holistic coaching paradigm is compatible with complex systems thinking. It subscribes to the two properties that distinguished complex systems from other system. (See Chapter 1.1)

1. "The interaction between the autonomous parts of the system produces emergence." For example, a player's psychological characteristics affect her basketball skills [Newland et al 2013].
2. "In addition to bottom-up causation, there is top-down causation." For example, the social climate of the team affects how effectively the player practices and plays. [Boyd et al 2014]

Table 3 shows a hierarchy of complex systems based on the holistic coaching paradigm. The table is composed around an individual player: she's located right in the center, at the scale n.

Scale	Entities			
n+1	Alligator team	Class	Immediate family	Friends
n	Alligator player			
n–1	Basketball skills	Physical capabilites	Psychological characteristics	Social skills

Table 3: Hierarchy of complex system around a player

3.3 Anomalies of the Prevailing Paradigms

To justify a paradigm shift in coaching, we need to find empirical evidence –
anomalies, that is. Or Kuhnian violations of "the paradigm-induced
expectations". [Kuhn 1962]

Table 4 shows four such anomalies. The methodologiy was inspired by Richard
H. Thaler. In the 1990's he promoted then-novel behavioral economics "by
writing about anomalies in people's behavior that could not be explained by
standard economic theory". [Gino 2017]

Research	Results	Anomaly
Swaab et al (2014): The too-much-talent effect. Team interdependence determines when more talent is too much or not enough.	"First, the actual marginal benefit of more talent decreased at a much faster rate than people believed it would. Second – – – the relationship between talent and performance eventually turned negative."	Adding to the cumulative effectiveness of the players may either enhance or harm the effectiveness of the team.
Sieweke and Zhao (2015): The impact of team familiarity and team leader experience on team coordination errors. A panel analysis of professional basketball teams.	"On the one hand, [team] familiarity is important for developing the mutual understanding that helps team members anticipate and adjust to each other' s actions, thereby improving coordination. On the other hand, too much familiarity might negatively affect coordination – – –."	The effectiveness of the team depends not just on the effectiveness of the individual players but also on how familiar they are with each other. The growing team familiarity may either enhance or harm the effectiveness of the team.
Ayer (2011): Big 2's and big 3's. Analyzing how a team's best players complement each other.	"– – – high-scoring point guards don't mesh well with high-scoring 2 guards. Talented, high-scoring centers fit well with more limited, defense-oriented power forwards who rebound very well, which also aligns with conventional wisdom."	"Constructing a team that can reach its full potential requires more than just acquiring talented players; these players have to fit well together."
Maymin et al (2013): NBA chemistry. Positive and negative synergies in basketball.	"Because skills have different synergies with other skills, a player's value depends on the other nine players on the court."	The effectiveness of individual players depends on the teammates and opponents. Thus the players' effectiveness is not cumulative but rather contextueal and relative.

Table 4: Research results that are anomalies regarding the positivistic and holistic coaching approaches

3.4 Further Anomalies of the Positivistic Paradigm

So, the effectiveness of a team does not correlate linearly with the cumulative effectiveness of its individual players. The positivistic coaching approach includes other assumptions that contradict research results.

Some of those anomalies are listed in Table 5. The table's left-hand side column is the same as the middle column in Table 2. Key theories of the positivistic coaching paradigm are presented. The right-hand side column presents the contradicting research results – or anomalies.

Assumption applied to basketball coaching	Basketball-related research result that causes an anomaly
There is an optimal technique for each task in basketball, and every player should use the similar technique.	"Biomechanical analyses have been used to examine kinematic variables related to free-throw technique - - -. [these] variables often demonstrate large inter-individual variability, suggesting players use widely different techniques." [Mullineaux and Uhl 2010]
Basketball is best learned in a linear fashion – gradually and systematically moving upwards in the hierarchy of skills, from simple to more complicated ones.	"- - - [nonlinear] enrichment programme is ideally suited for fostering specific sport skills - - -." [Santos et al 2016]
The effectiveness of a player correlates linearly with her relevant anthropometric and physical characteristics .	"NBA draft order appears to value anthropometric and athletic variables despite those variables not being reliably related to NBA success." [Moxley and Towne 2015]
There are optimal tactical decisions that always benefit a basketball team.	"- - -determining and interpreting latent structure on the basis of standard indicators of situational efficiency does not explain their entire functional dependency, thereby not giving complete insight into their interaction." [Jelicic et al 2010]
Shooting in games can be improved through practicing shooting without defense in practices.	"Basketball shots performed against a defender elicited significant behavioral changes [when compared to shots without defense]." [Gorman and Maloney 2016]

Table 5: Research results that cause anomalies.

3.5 Further Weaknesses of the Holistic Paradigm

So, the holistic coaching paradigm is involved only in anomalies regarding the linear correlation between the effectiveness of a team and the cumulative effectiveness of its individual players.

This isn't surprising because the holistic paradigm makes few conclusions about how to coach in praxis. If a player is coached as a whole and coaching is viewed as a complex social process, [Jones and Turner 2007], what does it actually mean? There are few answers.

The lack of practical applications jeopardises the status of holistic coaching as a paradigm. That is because a Kuhnian paradigm should include not just "key theories and laws" but also "the applications of those theories in the solution of important problems". [Bird 2018]

It is for a good reason that Cassidy writes: "If the sports coaching community fails to gain a greater understanding of holism, yet continues to use the phrase 'holistic coaching', the phrase has the potential to become meaningless." [Cassidy 2010]

One of the rare applications has been using questions as a coaching tool: "'- - - athlete-centred coaching' is often characterised by the application of a questions-based pedagogy with the intention of identifying and working towards shared goals." [Nelson et al 2010]

Due to the ambiguity of the term, holistic coaching has been interpreted variably.

On one hand, holistic coaching has been interpreted as a strict version of positivistic coaching. It's been concluded that once an athlete should be coached as a whole, then not just her practices but also her private and social life should be controlled – in a reductionistic fashion. [Puhakainen 1995]

On the other one hand, within holistic coaching the goal of enhancing performance has been questioned. It's been argued that "coaching should be more than winning and losing", or "coaching should foster the development of the whole person". [Mallett and Rynne 2010]

Conversely, our definition says that the goal of coaching is to optimise a team's "proficiency at manipulating the conflict in basketball games in their favour". So, from the viewpoint of complex coaching, coaching is about just winning and losing.

This doesn't imply that we're not concerned with "the development of the whole person". Rather, in this context it's assumed that an efficient coaching paradigm will enhance that development.

3.6 Revised Positivistic Coaching Paradigm

The previously discussed version of the positivistic paradigm puts the emphasis on the effectiveness of individual players. That proved to be a serious problem.

What would happen if we stack to the positivistic assumptions but shifted the emphasis onto the effectiveness of the team? Would that kind of a revised positivistic coaching paradigm work?

It's important to answer this question once and for all. Otherwise positivists may try to interpret phenomena in a positivistic way – they're dogged that way.

Since learning is specific, the revised positivistic paradigm would keep the practice tasks as basketball-representative as possible. Meanwhile it should consider the constraints of the power law.

The power law is another elementary, well-proven principle of sports practice. It says that the "performance continues to improve with task-relevant practice indefinitely, although the rate of improvement declines over time". [Yarrow et al 2009]

The representativeness of a practice task depends on how thoroughly "practice task constraints represent the competitive performance environment" and its "key individuals, events and objects." [Travassos et al 2012]

So, this would be the procedure in our revised positivistic paradigm:
1. We list practice tasks in the order of their basketball-representativeness.
2. We assess the rate at which the time spent on a task weakens its efficiency (because of the power law).
3. We run task 1 until its efficiency has dropped below that of task 2.
4. We run task 2 until its efficiency has dropped below that of task 3.
5. And so.

This suggestion is not merely my imagination. Rather, it has been suggested that methods should be developed to measure the representativeness of practice tasks. [Travassos et al 2012]

The suggested paradigm would still be positivistic. That's because it would be based on the assumption that optimal coaching procedure can be calculated and known in advance.

This *per se* is a serious problem regarding the credibility of the suggested paradigm: it has already been shown that positivistic assumptions can't be successfully applied to complex systems such as basketball.

The revised paradigm considers the representativeness essentially important. So, an anomaly arises anytime the basketball performance is enhanced by a practice task that has little or no basketball representativeness.

There are two types of those anomalies.

Type one anomalies are such where the basketball performance is directly enhanced by non-representative practice tasks. These are such anomalies:
1. Mindfulness exercise helps to improve players' free throw performance. [Gooding and Gardner 2009]

2. "A balance and proprioception routine" helps to improve players' passing skills. [Nikolaos et al 2012]
3. Basketball practice may be enhanced by practice where "random variable elements" are added to a basketball movement pattern. [Santos et al 2016]

In type 2 anomalies, the quality of a player's basketball performance is shown to correlate with the quality of her physical characteristics. This implies that the basketball performance can be improved through non-representative practice tasks that enhance certain physical characteristics.

These are such anomalies:

1. "Game intensity was shown to be associated with the individual level of aerobic performance - - -." [Abdelkrim et al 2010]
2. "- - - basketball is a game in which changes from one type of action to another are frequent, and hence agility and speed are important." [Ziv and Lidor 2009]
3. "- - - explosive power in the form of vertical and horizontal jumps is an important characteristic for elite basketball players." [Khlifa et al 2010]

So, the revised positivistic paradigm wouldn't work optimally either.

CHAPTER 4: Tactical Periodisation Paradign

4.1 Tactical Periodisation in General

We have now gathered enough anomalies and weaknesses to show that the two prevailing coaching paradigms should be challenged. Or, that "the revolutionary search for a replacement paradigm" is needed due to "the failure of the existing paradigm to solve certain important anomalies." [Bird 2018]

So, our complex basketball coaching paradigm must include "key theories and laws" that help to explain anomalies that the positivistic and holistic paradigms can't explain. [Bird 2018]

Also, CBC must comply "with other currently accepted theories" [Bird 2018], in our case for example complex systems thinking, the specificity of learning principle and the power law.

According to the specificity of learning principle, learning almost exclusively happens in the practiced task. [Green and Bavelier 2008]

CBC must be internally consistent, too. This guarantees that CBC is accurate and consistent, which are basic requirements for a paradigm. [Bird 2018]]

Some anomalies of the holistic and positivistic paradigms stem from its inability to explain how the effects of practice transfer to the basketball game performance. In other words, their mediation models aren't optimal.

To conduct a more advanced mediation model, we seek insight in a third paradigm, the tactical periodisation paradigm.

It is "planned manipulation of training loads with the aim of prioritising athlete readiness" for games. [Robertson and Joyce 2014] It was originally developed for soccer, but it has been applied to other invasion team sports as well, such as rugby. [Robertson and Joyce 2015] Here we apply it to basketball.

Tactical periodization has been called a method [Delgado-Bordonau and Mendez-Villanueva 2012], an approach [Tee et al 2018] and a process [Robertson and Joyce 2015]. Instead of "tactical periodisation", it has also been referred to as "strategic periodisation" [Robertson and Joyce 2018]. Here we refer to it as the tactical periodisation paradigm.

There are many aspects to it. First we concentrate on the division of the game performance into four dimensions: tactical, technical, physical and mental dimension. [Delgado-Bordonau and Mendez-Villanueva 2012] This four-piece mediation model (Table 6) will later serve as the basis for the mediation model of the complex coaching paradigm.

The direction of the arrow signals, which dimension **provides** substance and which **draws** it, should transference happens.

```
┌─────────────────────────┐
│   Tactical dimension    │
└─────────────────────────┘
             ↑
┌─────────────────────────┐
│   Technical dimension   │
└─────────────────────────┘
             ↑
┌─────────────────────────┐
│   Physical dimension    │
└─────────────────────────┘
             ↑
┌─────────────────────────┐
│    Mental dimension     │
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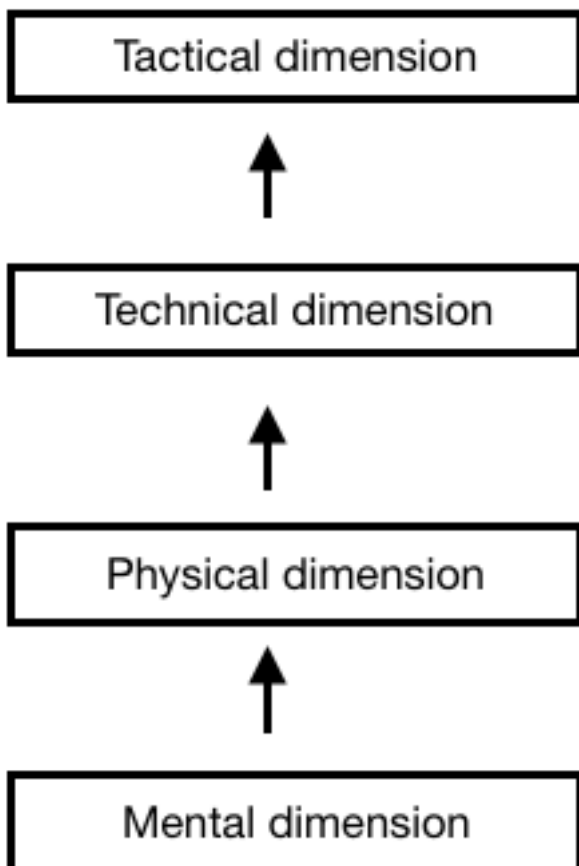
Table 6: The mediation model of dimensions according to the tactical periodisation paradigm.

4.2 Tactical, Technical and Physical Dimensions

A tactic is a "skill of employing available means to accomplish an end" [Merriam-Webster no date]. In the tactical periodisation paradigm, "tactics" refers to the collective skill of employing means – or the technical skills – in game situations.

Hence the outcome of a game is decided in the tactical dimension. [Delgado-Bordonau and Mendez-Villanueva 2012]. That is by definition: the tactical dimension is the only one that is directly involved in the actual interaction with the other team. The tactical dimension is applied in the conflict, that is.

A technique is a skill to use specialised physical movements movements. [Merriam-Webster no date] Technical is something related to this manner or skill.

In the tactical periodisation paradigm, all physical movements executed during a game are considered technical. That's because they are specialised in the sense that they take place in the context of a basketball game.

The technical dimension is always intertwined with the tactical dimension. [Delgado-Bordonau and Mendez-Villanueva 2012] Techniques are the available means employed by tactics to "accomplish an end". That is, to win basketball games.

The technical dimension is intertwined with the physical dimension, too. [Delgado-Bordonau and Mendez-Villanueva 2012] That is, only those techniques can be used that can be actualised through the players' physical capabilities.

The physical dimension includes all physical performance capabilities of a player: strength, endurance, quickness, and so. The physical dimension is limited to the capabilities as exhibited outside the context of a basketball game.

In other words, the running capacity as applied in the basketball context is a part of the technical dimension. Applied outside the context of basketball, the running capacity is a part of physical dimension.

4.3 Status of the Mental Dimension

In the tactical periodisation paradigm, it is claimed that the physical dimension "is directed by volitional and emotional states" [Delgado-Bordonau and Mendez-Villanueva 2012] or the mental dimension.

The claim is that the relationship between the mental and physical dimensions is analogous with two other relationships: the relationship between the physical and the technical dimensions, and the relationship between the technical and the tactical dimensions.

That's an invalid claim. The mental dimension does underlie the physical dimension – but it also underlies the technical and tactical dimension. That is mundanely true: if the player didn't have adequate motivation, she wouldn't play basketball in the first place.

Even if we exclude motivation from the discussion, we still find evidence that the mental dimension directly affects the other three dimensions. These are examples of such evidence:

- Tactical dimension: For the sake of reciprocity, players were "more likely to assist another player who had assisted them in the past". [Willer et al 2012]
- Technical dimension: Mindfulness exercise helped to improve players' free throw performance. [Gooding and Gardner 2009]
- Physical dimension: Autonomy support increased individuals' movement efficiency in a strength task. [Iwatsuki et al 2019a]

So, the position of the mental dimension is fundamentally different from the positions of the other three dimensions in the hierarchy.

Also the mental dimension itself is fundamentally different from the other dimensions. Unlike the tactical, technical and physical dimension, the mental dimension is never concretely manifested *in situ*.

This means that the mediation model of dimensions according to the tactical periodisation paradigm (Table 6) is flawed. We need to draft a new model for the complex basketball coaching paradigm. This is one the important differences between the tactical periodisation paradigmand CBC.

4.4 The Mediation Model According to Complex Basketball Coaching

The mediation model of the dimensions according to the complex basketball coaching paradigm is shown in Table 7. It illustrates how the dimensions of the tactical periodisation paradigm are organised.
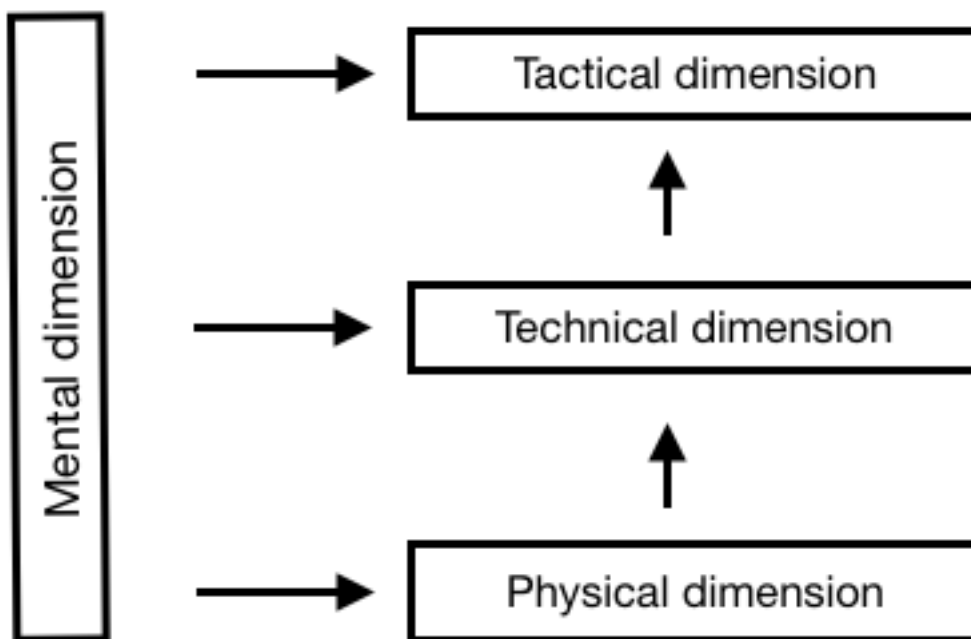
Table 7: The mediation model of dimensions according to the complex basketball coaching paradigm.

For the tactical dimension to improve, the necessary technical skills must be drawn from what the technical dimension provides. That is, new tactical skills may be executed only by utilising the players' technical skills more comprehensively than before. For example:

- *After a trapping full court man-to-man defense has been added to the team's playbook, the players should use their defensive footwork at a higher speed and for longer distances than before.*

In parallel, for the technical dimension to improve, the necessary physical capabilities must be drawn from what the physical dimension provides.

- *To learn to do defensive footwork at a higher speed and for longer distances than before, the players must utilise their more power and endurance more than before.*

4.5 Pre-empting the Providing Dimensions

Since the tactical dimension is the decisive one, why not orientate all practice tasks towards it? [Delgado-Bordonau and Mendez-Villanueva 2012] Why bother with the technical, physical and mental dimensions at all?

This is a logical and crucial question. Especially at the pro level, many coaches answer "Why not". They concentrate on the tactical dimension and run almost exclusively 5v0 and 5v5 tasks.

Yet in most cases this is a mistake. The reason is simple: the tactical dimension draws the required technical skills from the technical dimensions. After a while, the technical dimension can't provide any more skills. The relevant technical skills have been utilised. Or the technical dimension has been pre-empted.

- *Given their technical skills, the players can't execute the press defense almost any better than they are doing at the moment.*

The previous paragraph may be somewhat misleading. This pre-emptying of the providing dimensions is never complete. Or all relevant technical skills are never utilised but there's always some room improvement in the tactical dimension.

- *The spacing and timing of the traps can always be improved at least a little bit.*

Yet at a tipping point, this room gets so small that it becomes more efficient to improve the technical dimension. If this sounds familiar, it should: this another incarnation of the power law [Yarrow et al 2009].

- *Once the tactics of the trapping full court man-to-man defense have been practiced for a while, it may become more efficient to work on the players' footwork technique.*

The same is true regarding the technical and the physical dimensions. If technical dimension is being improved but the physical dimension is not, the technical dimension will eventually pre-empt the physical dimension.

- *Once the players' footwork technique been practiced for a while, it may become more efficient to work on their power and endurance.*

Another thing speaks on the behalf of considering all dimensions, not just the tactical one: it takes practice to keep up the level of the technical and and physical dimensions.

So, if all practice is tactic-orientated, the technical and physical dimensions are not just pre-empted, but they diminish. In four weeks of detraining, shooting skills may decline [Wee 2017] and "sport-specific power may suffer significant declines". [Mujika and Padilla 2003]

- *The effectiveness of the press suffers if the players' defensive footwork technique becomes less effective.*
- *The players' footwork technique suffers if they lose some of their power.*

4.6 The Providing Dimensions May Misfeed

So the transference may happen, if the providing dimension can provide what's required. Then the drawing dimension may draw skills and capabilities and utilise them in certain actions.

- *The players improve their technical footwork skills, and it helps to improve the timing of the traps in the team's full court press.*
- *The players improve their lower-body power, and it helps them to change direction more explosively in their defensive slides.*

But sometimes the transference doesn't happen even though skills have been learnt and capabilities enhanced. This may be because the providing dimension **misfeeds**. It means that the providing dimension provides skills and capabilities that the drawing dimension utilises marginally at best.

- *A player improves her technical footwork skills, but it doesn't help to improve the team's game performance because she doesn't get to play.*
- *The players improve their lower-body flexibility, but it doesn't help to improve any technical skill because none has been limited by the players' lack of flexibility.*

Misfeeding is a common problem in coaching. It is difficult to assess how likely the transference is. This assessment tends to be difficult even in hindsight.

- *Did the trapping man-to-man press prove because the players improved their technical footwork skills? Or was it because Coach Ally started to play the Alligators' best defenders for more minutes? Or did the press even improve?*
- *Did the players' footwork technique improve because they improved their lower-body power? Or because they learned to establish a better stance? Or did the footwork even improve?*

For the fear of misfeeding, some coaches do not do any mentally-orientated practice. This is understandable since the mental dimension is fundamentally different from the the other three dimensions. (Chapter 4.3)

Yet disregarding the mental dimension is also a mistake. It has been well documented that enhancing the dimension may positively impact the game performance. [Willer et al 2012; Kendall et al 2014; Uphill et al 2014]

4.7 The Mediation Model as a Key Theory

The above shows how the results of even non-representative practice tasks may or may not transfer to the game performance. That is something that the positivistic and holistic paradigms couldn't explain and that caused some of the anomalies discussed in Chapter 3.3.

By explaining these anomalies, the mediation model of the tactical periodisation paradigm enhances the accuracy of the complex coaching approach.

The model also complies with two other Kuhnian characteristics of a paradigm: consistency and simplicity. (Chapter 2.3) The mediation model is consistent with the specificity of learning principle and the power law. And the model with its four boxes and five arrows is simple relative to its explanatory power.

These characteristics make the mediation model of the tactical periodisation paradigm the first one of the two key theories of the complex coaching paradigm.

CHAPTER 5: Complex Causation in Basketball

5.1 Parallel Dimension and Scales

The mediation model of tactical periodisation paradigm shows the structure of the dimension that underlie the tactical dimension. (Table 7) What the model doesn't show is how that structure comes about – or how it originates.

To demonstrate that, we need a chart that shows the bottom-up and top-down causation in the context of a basketball team. In other words, a chart that exhibits the model of complex causality in basketball. That is Table 8.

Table 8: The model of complex causality in basketball.
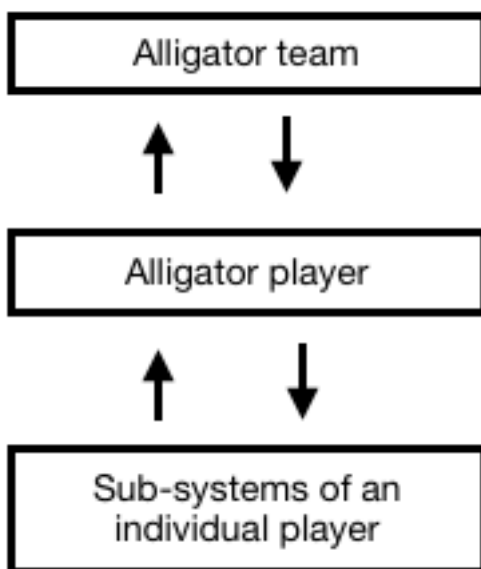
The two charts are closely related, as shown in Table 9. The dimensions on the left and the scales on the left are parallel since they regard the same entities.

It is in the tactical dimension where the team tries to optimise its ability to manipulate the interaction against the other team. In the technical dimension each player tries to optimise her technical skills.

Tactical periodisation dimensions	Complex systems scales
Tactical dimension	Team
Technical dimension	Player
Physical and mental dimension	Sub-systems of an individual player

Table 9: Hierarchies of complex systems and tactical periodisation dimensions.

The bottom scale/dimension pair is a little different: the sub-systems of an individual player regards two dimensions, the physical and mental one.

Despite the parallelism, there is a fundamental difference between the columns: causality works differently in them. This difference stems from the difference between the phenomena that the charts exhibit.

The left-hand side column exhibits a structure – the structure of the tactical periodisation dimensions. Since the dimensions are not complex systems, there is only bottom—up causality there. The providing dimension affects the drawing dimension but not the other way around.

- *A player's footwork skills affect the effectiveness of the team's full court press. But the effectiveness of the team's full court press doesn't affect a player's footwork skills.*

Conversely, the right-hand side column exhibits a hierarchy of complex systems. By definition, there causality works both bottom–up and top–down. (Chapter 1.1)

- *How a player plays full court press, affects how the team plays – for example it a trap is executed in time. And how the team plays press, affects an individual player plays – for example how quickly she moves.*

Due to this difference, the complex causality in basketball is the second one of to the two key theories of the complex coaching paradigm. It adds two essential properties to the paradigm. These properties are the same that set the complex systems apart from other system. (Chapter 1.1)

1. Top–down causation in practicing.
2. Emergence in practicing.

The next two chapters are devoted to those properties.

5.2 Top–down Causation in Practicing

In basketball practicing, there is both bottom-up causation and top-down causation.

The functioning of the lower scale systems affects functioning of the higher scale systems.

- *How a player executes defensive footwork affects how the team's functions while defending a full court man-to-man trapping press.*
- *How a player produces power affects how she functions while doing defensive footwork.*

And also, the functioning of the higher scale systems affects functioning of the lower scale systems.

- *How the team's functions while defending a full court man-to-man trapping press affects how a player functions while doing defensive footwork*
- *How a player does defensive footwork affects how she produces power.*

So, tactics-orientated practice – intended to improve primarily the tactical dimension – inevitably affects the functioning of not just team scale but also the functioning of player scale and the sub-systems of a player scale.

According to the specificity of learning principle, learning almost exclusively happens in the practiced task. [Green and Bavelier 2008] Because the top–down causation affects how the lower scales function, it also affects what we learn.

What this implies is that it is possible to improve the technical, physical and mental dimensions through tactic-oriented training. This approach has two distinct advantages:

1. It saves practice time since multiple dimensions are improved simultaneously.
2. It makes sure that the providing dimension doesn't misfeed the drawing dimension.

A version of this idea is expressed in the tactical periodisation paradigm, too "- - - the tactical, technical, physiological and psychological elements are never trained independently. Everything is included - - -." [Delgado-Bordonau and Mendez-Villanueva 2012]

This is the second essential difference between the tactical periodisation paradigm and the complex basketball coaching paradigm. From the viewpoint of CBC, the problem with the quote lies with the word "never". As shown above, sometimes it may be quite efficient to exclude some dimensions from practice tasks.

For example, basketball-representative practice may help to maintain the lower-body power. But improving the power may require non-representative practice, or practice independent from the tactical and technical dimensions. [Santos and Janeiro 2011]

This been recognised in the context of the tactical periodisation paradigm and rugby, this is discussed by Tee al (2012): "Resistance training methods are indispensible in rugby union —, and it follows that training can therefore never be wholly tactical in nature."

5.3 Emergence in Practicing

In complex systems, the interaction of its autonomous parts produces emergence. So, based on the input, one can not exactly know what the output will be.

This is a fact. The question is how a coaching paradigm should deal with the fact. This is where lies the third essential difference between the tactical periodisation paradigm and the complex basketball coaching paradigm.

In tactical periodisation, "Given the high unpredictability that exists during a match, a coach tries to create predictability through preparation, planning and training. Accordingly, every training session is designed to fit the coach's game model." [Delgado-Bordonau and Mendez-Villanueva 2012]

Also, "The systematic repetition of the tactical principles of play should enable the players to transform the match-play patterns that the coach wants into habits. Creating habits is possible only when the brain has experienced the same or similar situations and has 'recorded' them." [Delgado-Bordonau and Mendez-Villanueva 2012]

Here the most effective way to tame the emergence is to minimise it – to make the game or the conflict unfold as planned. When this happens, the team has the advantage because its players' brains have recorded the recurring situations and know how to act.

Up to a certain point this is true. Teams use certain tactics and prepare for how the opponents may react. Doing this well improves the tactical dimension and helps to win.

- *Coach Ally had prepared the Alligators' full court press well. The players had experienced and recorded all press break tactics that the Crocodiles attempted.*

But by definition, all emergence can't be controlled. If it could, basketball wouldn't be a complex system. So the question becomes how the practice time should be divided between learning to control the emergence and to adapt to it.

There is no exact general answer to the question. However, it is safe to say that the tactical periodisation paradigm puts a lot faith into learning to control the emergence. The complex basketball coaching paradigm leans more towards learning to adapt to the emergence, whatever it may bring about.

This tendency can be justified in at least these ways:

1. We are always up against a thinking opponent. We try to force our tactics upon them so that they must adapt to it – and vice versa. If the teams are somewhat evenly matched, the difference may well be in the adapting part.
2. Basketball skills are executed in biomechanically different ways depending on the situation. [Maimon et al 2020; Maarseveen and Oudejans 2018] Since all game situations are unique, this suggests that adaptability of the skills is the key.
3. Technical skills and physical capabilities may be improved through differential learning. [Konttinen and Kuokkanen 2015; Mateus et al 2015; Poureghbali et al 2019] Differential learning is a method that emphasises "importance of variability during learning" and "can be characterised by adding random variable elements to a movement pattern". [Mateus et al 2015]

The complex basketball coaching paradigm owes a lot to the tactical periodisation paradigm, but the three differences discussed above clearly set them apart.

These differences may have to do with the differences that soccer and basketball have as sports. Generally speaking, the differences and similarities between invasion team sports is an interesting subject but not to be discussed in this book.

5.4 Creativity in Basketball

There is a missing link here. That is, a factor or a skill that allows the team and the players to adapt effectively to emerging situations.

This adapting is a tricky task because each emerging game situation is unique. That is for two reasons.
- It is improbable that the same ten players are going to twice end up in exactly the same spots, in the same postures, and so on.
- Even if they did, due to the prior experience, their perception of the situation is going to be different the second time.

This missing link mentioned seems to be creativity.

Creativity has been defined as
- *"the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context". [Plucker et al 2004]*

In basketball, the decision making process produces a perceptible product – for example a shot, a pass, or simply standing still. This product is by definition novel because the situation in which it appears, is unique, as noted above.

So, even a formerly executed action – like standing still – is novel because the environment where it's produced is novel. Also, a person never repeats any action using exactly the same movement pattern. [Glazier and Mehdizadeh 2019]

The perceptible product is more or less useful given its social context. The degree of usefulness may be assessed by how effectively it manipulates the conflict in favour of the team.

So, creativity is inevitably and constantly present in basketball. This applies to both

1. Collective creativity = The team's adapting to the conflict with the other team.
2. Individual creativity = A player's adapting to the interaction with her teammates.

Even though all actions are novel, they are not novel to the same degree. This equation can be used to assess the degree of novelty:

- *Degree of usefulness x Degree of novelty = Degree of creativity*

Why then should a team try to enhance the creativity of their actions? One could argue that enhancing the usefulness is enough and that the degree of novelty is irrelevant *per se.* That is, it matters only for long as it affects the degree of usefulness.

Our counterargument is that enhancing the degree of creativity is important *per se*, because it predicts the team's future effectiveness. The higher the degree of creativity, the more readily the team can be expected to adapt to the game situations that will emerge. This also makes the degree of novelty relevant *per se*.

For example, so far the Alligators and the Crocodiles have been evenly matched. The Alligators repeat the same common tactical and technical actions over and over again. The Crocodiles exhibit more novelty and creativity in their actions.

Based on this, we expect the Crocodiles adapt better when the teams face new types of challenges. Depending on the competition system, this may happen for example when the teams move on from the conference play to the national or regional playoffs.

This leads us to a profound conclusion: coach should design practices so that novel tactical and and technical actions will appear. Put in other terms, she should enhance the variability of practice.

5.5 Defining Complex Basketball Coaching

We started out with this question: What kind of a coaching paradigm optimises the effectiveness of basketball practice?

Gradually our answer has turned out to be the complex basketball coaching paradigm. Its main features have been discussed above but we are still lacking a formal definition.

Previously, we defined basketball coaching as "activity where a team is trained, instructed, and taught in order to optimise its proficiency at manipulating the conflict in basketball games in their favour".

What then sets CBC apart from other types of basketball coaching? Remember, "a formal definition corresponds to the formula an X is a Y + distinguishing characteristic, where Y is a class word or superordinate term". [Pearson 1998]

Based on what the previous two chapters said about the distinguishing characteristics of CBC, we can define it as:

- *Basketball coaching that considers and utilises a) the interaction between relevant complex system scales and b) the emergence produced by the interaction between a team's players and the conflicts with other teams.*

Complex coaching in any invasion team sport can be defined similarly, or as "coaching that consider and utilises" and so on.

Now, these were the theoretical musings I promised to deliver. The last two chapters will be the practical part – the part that when applied will win us games.

First, in Chapter 6 we'll discuss coaching guidelines based on CBC. Then finally in Chapter 7, we'll see some practice tasks or drills that fit our paradigm.

CHAPTER 6: Coaching Guidelines

We are now ready move towards the practical applications of the complex basketball coaching paradigm. Chapter 6 and 7 are dedicated to them.

First in this Chapter 6 we list coaching guidelines of the complex basketball coaching paradigm. They are derived from the theoretical conclusions of the previous chapters.

The guidelines point the direction towards which coaching should shift but they are not strict or absolute. Rather, each guideline is relative. Balancing needs to be done between complementary pairs.

They are "things, events and processes" that seem "to be contraries but are mutually related and inextricably connected". [Engstrøm and Kelso 2010] In our context, complementary pairs include such as:
- *Representativeness ~ Number of repetitions*
- *Whole ~ Part*
- *Tactical ~ Technical*
- *Technical ~ Physical*
- *Physical ~ Mental*
- *Long-term ~ Short-term*
- *Perturbation ~ Adaptation*
- *Variable ~ Relevant*
- *Skills ~ Degree of difficulty*
- *Complement ~ Accumulate*
- *Generalist ~ Specialist*
- *Speed ~ Accuracy*

In Chapter 7 we look at some practice tasks or drills that are designed in accordance with the guidelines presented here.

6.1 Improve the Interaction Within the Team

So, improve the interaction of the team. The imperative stems from this train of thought;

- The tactical dimension is the only one that has intrinsic value when it comes to winning basketball games.
- The tactical dimension is actualised when the team functions.
- This functioning consists of the players' interaction with each other.
- Because learning almost exclusively happens in the practiced task [Green and Bavelier 2008], while practicing players should continuously interact with each other.

Our sole goal is that the team improves its effectiveness in 5v5 competitive play. Because learning is specific, players learn to play 5v5 by playing 5v5. And they learn to compete by competing.

This makes playing 5v5 competitively – or scrimmaging – our default practice task. Yet because of the power law, we know that scrimmaging isn't going to be the only practice task. (Chapter 3.6)

So, choose any other practice task only after justifying the choice. There must be a plausible explanation on how the practice effect transfers to the game performance. This justifying can be done using the mediation model of dimensions and the model of complex causality in basketball.

If the other practice tasks can't be justified, don't choose them. Justifying them is easier if the include elements of interaction. This can mean a variety of things:

1. Have multiple players involved in the practice tasks: 3v3 rather than 2v2; 2v2 rather than 2v0; 2v0 or 1v1 rather than 1v0).
2. Keep practice tasks open rather than closed. That is, structure the tasks so that the actions required are unpredictable rather than predictable. This reflects the essence of basketball as an open-skill sport. [Wang et al 2013]
3. Whenever there is dribbling or shooting in the practice tasks, make sure that there is passing, too.

4. To help the players communicate verbally, teach them specific terms for common basketball actions.
5. Have players synchronise their movements even if there is no ball involved in the practice tasks (for example warm-up runs).

These are not absolute guidelines but rather suggestions. A complementary pair relevant here is *Representativeness ~ Repetitions*. Making a practice task representative takes many players which cuts down the number of receptions per player. A proper balance must be sought.

For example, a pick-and-roll situation is optimally representative only if the ball handler has four teammates and there are five defenders trying to stop them. If you are looking to improve the ball handler's technical skills, the quality of repetitions is high but the quantity is low.

On the other hand, you may have all ten players continuously handle the ball 1v0 using chairs as screens. This will lower the quality of repetitions but raise their quantity.

6.2 Utilise Top-Down Causation Optimally

As demonstrated by the model of complex causality in basketball, the functioning of a system at an upper scale affects the functioning of related systems at lower scales.

This implies that in basketball practicing, the functioning of the team affects the functioning of the scale of individual players and further down the scale of an individual player's sub-systems.

Regarding the mediation model of dimensions, this means that improving the tactical dimension may also improve the other three dimensions – technical, physical and mental.

For example:
- Small-sided scrimmaging may enhance technical skills and aerobic capacity. [Delextrat and Martinez 2014]
- A player's long-term involvement in basketball may change the way her brain functions. [Zhang et al 2018]
- Endurance running may cause "unexpected increases in oxytocin" which tends to make people more co-operative. [Pepping and Timmermans 2012]

Your job is to utilise the top-down causation optimally. Plan and lead the practicing so that the net gain in all dimensions combined is maximised.

A relevant complementary pair here is *Whole ~ Part*. The whole or the upper scale system affects the lower scale systems or the parts, and vice versa.

6.3 Improve the Technical Dimension to Improve the Tactical Dimension

The tactical dimension can only improve as far as the technical dimension allows. That is because all tactical skills are executed by applying technical skills. (Chapter 4.2) So, in order to improve the tactical dimension, improve the technical dimension, too.

This implies three equally important ideas that are often disregarded:
1. When planning to improve the tactical dimension, consider if the technical dimension can reasonably be expected to provide the technical skills required.
2. Coach technical skills that the tactical dimension requires.
3. Don't coach technical skills that the tactical dimension doesn't require.

Say, you think about implementing an offence that includes backdoor cuts and alley-oops. First, you must consider if the team will be technically able to execute the cutting, passing and finishing required.

There are three alternatives for an answer:

1. The team already knows the required technical skills. —> Specific technically-orientated practice is not needed.
2. The team doesn't know the required technical skill but can be expected to learn them within an acceptable time range. —> Specific technically-orientated practice is needed.
3. The team doesn't know the required technical skill and can't be expected to learn them within an acceptable time range. —> The offence shouldn't be implemented.

In the second case you should have players practice cutting backdoors and passing for and finishing off alley-oops. It other words, you should coach technical skills that the tactical dimension requires.

Often this type of technically-orientated practice is neglected. To cover up her own mistake, coach may blame the failure on the players' "lack of fundamental skills" or something.

On the other hand, if you have players successfully practice backdoors and alley-oops, implement the actions into the team offense. Otherwise you are misfeeding the tactical dimension.

Also this idea is often violated. To cover up her mistake, coach may say that she is "improving the players' fundamental skills" or something like that.

A relevant complementary pair here is *Tactical ~ Technical.*

6.4 Improve the Physical Dimension to Improve the Technical Dimension

The relationship between the physical and the technical dimensions is parallel with the relationship between the technical and the tactical dimensions. So some things in this chapter may sound familiar.

The technical dimension can only be improved as far as the physical dimension allows. That is because all technical skills are executed by applying physical capabilities. (Chapter 4.2)

For example, a player can only execute an alley-oop technically if she can jump high enough to catch the ball and finish the play while still airborne.

Plenty of physical capabilities have been found to be important in basketball
- Lower-body power [Delextrat and Cohen 2008]
- Aerobic capacity [Narazaki et al 2009]
- Anaerobic capacity [Mackovic 2012]
- Running velocity [Abdelkrim et al 2010]
- Agility [Ziv and Lidor 2009]

These results show that some improvements in some physical capabilities transfer all the way to the technical dimension and onwards to the tactical dimension.

However, when improving the physical dimension, there is a risk of misfeeding the technical dimension. For example, basketball a lot of time has been used on static stretching [Simenz et al 2005] even though flexibility is not an essential physical capability in basketball. [Delextrat and Cohen 2008]

"Increased hamstring flexibility" has even been found to be "associated with a decrease in vertical jump height" [Skaggs and Pace 2015] – in other words harmful to the basketball performance.

On the other hand, there are studies that suggest that in some cases improving flexibility may be beneficial. [McGill et al 2012; Rajeeva and Venkatesh 2015]

This demonstrates that when it comes to physically-orientated practice, you must carefully justify all practice tasks. Come up with a plausible explanation on how the effects of the practice tasks transfer to the game performance – or don't use the tasks.

A relevant complementary pair here is *Technical ~ Physical.*

6.5 Always Consider the Mental Dimension

As shown by the mediation model of dimensions (Table 7), the mental dimension underlies all other dimensions. So, consider the mental dimension in everything you do.

This effect can be direct. For example, the mental dimension – a player's reciprocity – can affect to whom the player passes the ball. [Willer et al 2012]

Or the effect can be indirect. The mental dimension – or a player's enhanced mindfulness – [Iwatsuki et al 2019a] may affect the tactical dimension through enhancing the technical dimension – or changing her free throw shooting accuracy.

Unlike the other three dimensions, the mental dimension is never concretely manifested. Maybe that's the reason why it's so often neglected.

Don't make that mistake. Always consider how you can improve the efficiency of practice through enhancing the effectiveness of the mental dimension.

A relevant complementary pair here is *Physical ~ Mental.*

6.6 Consider Short-term and Long-term Effects

Different things may be effective n the short term than in the long term. Learn to consider and utilise this fact. Or to balance the complemtentary part *Short-term ~ Long-term*.

For example, to maximise the short-term success maybe you should run almost exclusively tactically-orientated practice tasks. That's the quickest and most direct way to enhance the tactical dimension.

However, when it comes to maximising the long-term success, you probably shouldn't. Eventually the technical and the physical dimensions are pre-emptied, now matter how cleverly you utilise them. And when the providing

dimensions have nothing more to provide, the improvement of the tactical dimension ceases.

Additionally, if there is little technically- and physically orientated practice, those dimensions not only get stuck but regress. It takes much practice time to even maintain one's technical skills and physical capabilities.

Whether you emphasise the short-term or the long-term effectiveness of the team depends heavily on the context. The more juvenile the team is, the more you probably want to emphasise the long term.

6.7 Prepare for Inevitable Emergence

Because a basketball game is a conflict of two complex systems, there will inevitably be emergence. There will be things happening that can't be predicted.

So, prepare your team for emergence.

Run practice tasks where emergence happens – tasks that are open rather than closed. Generally, there are various methods to add to the variability of practice. Some specific ideas are presented in Chapter 7.

In constraints-led approach the constraints are manipulated. Players then self-organise to function successfully under the new constraints. [Renshaw et al 2010] This ability to self-organise is a feature that characterises complex systems. [Bittencourt et al 2017]

Without using this exact term, basketball coaches have always manipulated the task constraints of practice tasks. This includes manipulating the number of players on a team, the size of the playing area, the duration of the shot clock, and so on.

Utilise the self-organisation in order to enhance the game performance. For example, if you want to enhance the team's three-point shooting, you may move back the line by a meter. The assumption is that:

1. Shooting from 7.75 meters is a perturbation in a player's shooting.
2. She self-organises and starts hitting threes from 7.75 meters.
3. In game situations, this adaptation helps her to hit threes from 6.75 meters and further out.

In the constraints-led approach, the constraints are applied outside the sub-systems of individual players. Or the players are allowed to stick to their familiar movement patterns for as long as they adapt to the constraints. Novel movement patterns may or may not emerge.

Conversely, the differential learning method is characterised by "adding random variable elements to a movement pattern". [Mateus et al 2015] This perturbation forces the players to use novel movement patterns. There is self-organisation taking place at the scale of a player's sub-systems.

Say, you want to enhance three-point shooting through differential learning. You may have players shoot threes under different unaccustomed conditions: off a full squat, feet turned inwards, off-hand in front of the ball, and so on.

Here, too, the idea is to utilise self-organisation:

1. A player shoots threes in a large variety of pre-determined, unaccustomed ways. This causes a perturbation in a her shooting.
2. Through self-organisation she adapts to different conditions.
3. This enhances "the detection of the ideal movement and adapting more quickly to a new situation" [Moreno and Ordeno 2015], or hitting threes in game situations.

How does the specificity of learning principle fit this preparing for emergence? How is this preparation possible since learning almost exclusively happens in the practiced task? [Green and Bavelier 2008]

We defined basketball practice as activity that aims to optimise the proficiency of a team at manipulating the conflict in basketball games in their favour.

(Chapter 1.3) The goal of each practice task is to enhance this proficiency. So, a practice task is not to execute a certain skill but to adapt to a certain situation and to manipulate it in your favour.

For example, when practicing shooting, the task is not to hit shots from certain spots using certain techniques. Rather, the task is to adapt shooting to variable conditions and to manipulate the flight of the ball accordingly. So, even obscure-looking shooting practice tasks can be in accordance with the specificity of learning principle.

A relevant complementary pair here is *Perturbation ~ Adaptation*.

6.8 Keep the Adaptations Relevant

Your team and its players should learn to adapt to different situations and to manipulate them in your favour. To achieve this, make practice tasks variable. And yet, keep the adaptations relevant.

Design the practice tasks so that adaptations to emerging situations will likely enhance the effectiveness of the team. This balancing of variability and relevancy is one of the difficult questions any coach will eventually face. [Moreno and Ordeno 2015]

Yes, this is a complementary pair: *Variable ~ Relevant.*

Due to the positivistic coaching paradigm (Chapter 3.1), basketball coaches have traditionally fallen on the too-little-variability side of the fence. Yet the too-much-variability side also exists. [Moreno and Ordeno 2015]

The easiest missteps to spot are the task constraints that require adaptations that are not within basketball rules. This principle may sound obvious but it is often violated.

For example, there may be a 1v1 rebounding drill where coach shoots the ball and whoever gets it, tries to score at the same basket. Here it is essential to

adapt quickly from not knowing if you're playing defense or offense in that end of the floor to playing offense or defense.

Yet while rebounding in a game, players always know who's on defense and who's on offense at a certain end of the floor. So, to the primary adaptation required by the practice task is not within the basketball rules.

These are some other typical practice tasks of the same kind:
- A group or a player starts at mid-court and gets to choose which way they attack (to make the defense react quickly to the actions of the offense).
- In the scrimmage excessive fouling is allowed (supposedly to make them play aggressively).
- Players skip and hop with the ball in their hands before they take a shot (to work on plyometrics and to add variability to shooting practice).

So, always design practice task constraints so that the consequent adaptations are within the basketball rules. This way the adaptations the players make are directly applicable to game situations.

The practice task constraints may also be non-optimal in another, less obvious way. They lead to adaptations that are within the basketball rules, but that might yet be negative regarding the effectiveness of the team.

It's hard to tell in advance which one will be the case. Sometimes it's hard even in hindsight because we are dealing with complex systems. So, pay attention to what's happening. Try different task constraints. Adjust them and vary them.

For example, you may shorten the shot clock to 12 seconds to put an emphasis on transition offense and defense. This may be a good choice for some teams.

With some strong teams you may want to down to 8 seconds to really make them quicken the pace. With some weak teams 8-second shot clock will lead to nothing but turnovers and three-point heaves.

For those weak teams shortening the clock to 14 seconds may do the trick. But some some strong may not need to make any significant adaptations because of the 14-second clock.

6.9 Use Context-appropriate Equipment

What's the quickest way to improve the technical skills of your team?

Scale down the equipment: lower the baskets and start using balls of a smaller size and weight.

The answer may surprise some but in the complex basketball coaching paradigm it is the logical.

According to our definition "basketball is an invasion team sport where the conflict between the two teams is confined by the basketball rules". (Chapter 1.3) The rules determine the height of the basket the size of the ball.

Rule changes affect the relation between the equipment and the players' physical capabilities. The physical dimension provides for the technical dimension, and after the equipment has been scaled down, the physical dimension could provide more.

Shooting would become easier for the players. Or their technical skills would improve. A complementary pair relevant here is *Skills ~ Degree of difficulty.*

In most cases, coach can't change the equipment her team uses. The rules are what they are. But there are two types of cases it is possible.

First, in children's basketball the regulations are often lax, or even non-existent. Coach or teacher may be left on her own to pick the equipment. Also, when organisations – associations, clubs, schools – make their age-group rules, coaches and teachers should have their say.

One idea behind scaling down the equipment is to allow kids to adopt the same approximate motor patterns they will use later on. This regards for example shooting, passing and dribbling. If the basket is too high for them and the ball too heavy, children adopt motor patterns that are not transferable to later contexts. [Cordovil et al 2009]

Another idea is raise the success rate – for example shooting percentage. That's because success "increases motivation. This may give the children more enjoyable experiences, so they will choose to continue to practice basketball and put out more effort." [Aries-Estero 2013]

This idea of raising the success rate applies to adults' recreational and veteran basketball, too. Why should the regular 3.05-meter basket and the size 7 ball be used in those contexts? Since the players have considerably lesser physical capabilities than elite players, why not have them use scaled-down equipment?

6.10 Nourish Diversity Within the Team

Diversity in the workforce helps an organisation to succeed. [Rock and Grant 2016] There are plenty of reasons why that should be the case. Shortly put "diverse groups respond better to environmental challenges because the diverse skill sets offered by minority groups". [Pink-Harper et al 2016]

Diversity regards a bunch of things: age, gender, race, ethnicity, religion, sexual orientation, "leadership styles, physical characteristics, cognitive patterns and personality traits". [Prasad et al 2005]

This is in accordance with the complex basketball coaching paradigm. The "environmental challenges" mentioned are equivalent to the emergence in CBC.

So, nourish diversity in your team. Recruit players with diverse skill sets, diverse psychological characteristics, diverse demographic backgrounds.

And provide them with opportunities to use their diverse strengths – something that's often neglected. [Pink-Harper et al 2016]

CBC helps to explain an anomaly unexplained by the positivistic and holistic paradigms: the too-much-talent effect, or why adding to the cumulative effectiveness of the players may harm the effectiveness of the team. [Swaab et al 2014] (Table 4)

The explanation lies in the definition of talent. If talent is defined narrowly, recruiting talented players will limit the scope of their cumulative skills. That in turn makes it difficult for the team to respond accordingly to "environmental challenges" or emerging game situations.

When Swaab et al found that the too-much-talent exists in the NBA, they operationalised talent as the estimated wins added or EWA. [Swaab et al 2014] It's safe to say that the metric overemphasises the importance of offense. So, when teams think they are accumulating "talent", they may be actually accumulating offensive prowess as measured by statistics.

Generally speaking, the importance of offense tends to be overestimated in the league: "- - - the ability to accumulate points dominates player evaluation in the NBA." [Berri et al 2007]

Regardingly, it's been found out that when valuing NBA players, it's essential to consider how they complement each other. [Kuehn 2016] At least in the Brazilian league, diversity of a player's skills help the team to win. [Rangel et al 2019]

So, be careful how you define "talent" or "skill". Always assess your players as parts of the team. A relevant complementary pair here is *Complement ~ Accumulate.*

6.11 Consider the Benefits and Limits of Individual Variation

When an athlete executes techniques, her movement patterns are shaped by "ubiquitous processes of physical self-organisation - - - and the confluence of interacting organismic, environmental, and task constraints imposed on the athlete ". [Glazier and Mehdizadeh 2019]

So, there are no optimal techniques for all athletes. This is one of the crucial points where the positivistic coaching paradigm went wrong. (Chapters 3.3 and 3.4) Even individualised, "athlete-specific optimum sports techniques" are extremely difficult to identify even in closed-skill sports. [Glazier and Mehdizadeh 2019]

In open-skill sports such as basketball that is impossible because "task and environmental constraints vary continuously". [Glazier and Mehdizadeh 2019] That is a common feature of complex systems.

Use this for the benefit of your team. Give up looking for generalised optimal techniques and forcing them upon players. Rather, help them find individualised techniques that allow them to function as effective parts of the team.

This doesn't imply that "anything goes" – that any technique is just as good as another one. There are limits to the room for individual variation. Biomechanics are still the same for all.

So, a technique can be beneficially individualised or harmfully strayed from the general principles of biomechanics. Where does the line lie between the two?

There is no sure way to tell. As the coach, you assess the situation, come to a conclusion and coach accordingly.

For example, in a jump shot there is usually "a slight forward inclination of the trunk". [Okazaki et al 2015] Some have suggested the trunk should be at vertical position at the moment of the ball release. [Okazaki et al 2015]

Backward inclination is associated with declining the accuracy of the shot. [Okazaki et al 2015]

That's generally speaking. But in coaching, you are not speaking generally but specifically about specific players. Consider these three three-point shooters:

1. Amanda inclines clearly forward. Or is it just good for her? Or is it too much? She's strong Maybe staying more vertical would allow her to release the ball higher and take more threes?

2. Barbara shoots off a vertical trunk position. Is it good for her? Or is it many of her threes are short? If she inclined a little forward, maybe that would help her transfer more vertical velocity to the flight of the ball?

3. Cecilia inclines backward and shoots average at best. Shouldn't her trunk position be straightened? On the other hand, she's small and the backward inclination helps her to get some shots off. Maybe the backward inclination enhances her chances of playing at a high level?

6.12 Recruit Basketball Coaches

When recruiting assistant coaches, recruit basketball coaches – rather than specialists of the physical or mental preparation. That is because in basketball coaching, the transference to the tactical dimension is everything.

The technical, physical and mental dimensions are not important *per se*, but only as far as they affect the level of the tactical dimension. So, an assistant coach most important skill is being able to enhance the transference from one dimension to another.

Yet it's certainly an advantage if the assistant coach is a specialised strength and conditioning coach or a psychology major. However, most often there is not a person available who's both a basketball coach *and* a specialist for example in S&C coaching. Rather, it's going to be either a basketball coach *or* a S&C coach.

A complementary pair relevant here is *Generalist ~ Specialist.* Recruiting a generalist means coming up with a basketball coach who's interested in S&C training. The upside here is her ability to consider the transference mentioned. The downside is her limited knowledge about S&C training.

This downside can be compensated for. The assistant coach can consult specialists. And actively educate herself about the subject starting Day 1.

The above only regards basketball practicing. Outside its scope players will need the services of a physiotherapist, doctor, psychologist, nutritionist and so on.

6.13 Vary Your Learning

The power law applies to you, too. Meaning, if do the same things over and over again, you are not improving as a coach. So, in order to develop, vary what you do

These are some suggestions on how you can enhance your professional development. Certainly not all suggestions are applicable to your situation but never mind. Do what you can and what seems beneficial.

1. Change the context where you work. Move to a new team, club, age group, school, city, country.
2. Change your role. Change from head coach to assistant, or vice versa. From assistant to S&C coach, and so on.
3. Recruit new assistants. Make sure they are basketball coaches with varied skill sets.
4. Visit some other coach's practices. Doing it weekly for a season is the best option. Then you really get to understand the coach's long-term thinking.
5. Watch games from different leagues. Don't get stuck with your league or your favourite NBA team. Watch games of both sexes and different teams, leagues, levels, age groups, countries.
6. Get to know experts on variable subjects. The means to do this will vary depending on your situations. At elat social media is available for everyone.

7. Study a subject other than basketball. Depending on where you live, you can attend different classes or courses. And no matter where you live, there are on-line courses available on any subject you can imagine.

8. Take a break from coaching. It's difficult to reflect and change your ways if you are continuously coaching. Taking a break may mean different things – from taking a whole season off to having a good long summer vacation.

6.14 Raise the Intensity

Basketball games are intense. So, the scrimmages must be intense. So, get your team to play hard in practices. Raise the intensity.

Nothing can compensate for the lack of intensity. If there is too little intensity in the scrimmage, it's not specific practice.

This is an important explanation for some coaches' success. A coach's methods may be average otherwise but if she gets her team to play consistently hard at practice, she's going to succeed.

It's difficult to maintain high intensity, practice after practice after practice. On the plus side, it has been shown that coach really can raise intensity at least by reducing social loafing. [De Backer et al 2015]

The high intensity will enhance the game performance both directly and in directly.

- Directly: The high intensity of scrimmaging enhances the intensity of the play in games.
- Indirectly: The high intensity of scrimmaging enhances emergence. Thus the team and players meet more and more variable situations that they must adapt to. They learn to better deal with the trade-off between the complementary pair of *Speed ~ Accuracy.*

You may think your team is already scrimmaging at a high intensity. It's probably not. Teams can play way much harder than most coaches ever realise. We are used to accepting half-speed, half-effort soulless basketball.

6.15 Make the Players Struggle in Order to Learn

Above we discussed constraints and intensity. Alone they accomplish nothing. They must be accompanied with the motivation to and the opportunity to learn.

To give the players opportunities to learn, set the practice tasks so difficult that they struggle to execute them. There must be lots of failures. If there are not, the tasks are too safe, too easy.

Adapting practice tasks is an important part of your job. On the average, the tasks are too easy. Coaches often want to make sure that players can do some basics. Also, we want to please players, and we know that players don't like to struggle. Like all humans, they prefer to do what they know they can already do.

Once the practice tasks are set difficult enough, let the players struggle to deal with them. If the players can't do it, help them or change the task.

It is not a failure if you sometimes give the players too difficult tasks. The real failure is constantly giving the player tasks that are so easy that they don't need to struggle.

6.16 Consider Complex System Scales Above the Team

Coaching concentrates on the scale of the team and the scales below it – the scale of the individual players and their sub-systems. This book and the complex basketball coaching paradigm in general are no exceptions.

This emphasis is not a mistake, but we shouldn't forget about the upper scales, either. Consider complex system scales above the scale of the team.

Those scales are the framework of your team. They determine where your team practices, how often, how many games you play, how much money (if any) you make, how you can recruit players, and so on.

In other words, the framework dictates much of what you can do as a coach. Considering this, it is surprising how little the upper scales are discussed in coaching.

On the other hand it is understandable because most of what happens in the upper scales is outside the coach's control. Besides, most coaches are coaches because they want to coach – not to do administrative work at the club, or so.

Yet I have two suggestions.

First, carefully consider how the upper scales should affect your coaching. In some ways they limit what you can do. Accept those limitations or don't take the job. For example, if the school team can only practice on Tuesdays and Thursdays, then it can only practice on Tuesdays and Thursdays.

But also consider the opportunities that the upper scales provide. These opportunities depend on the context so take a long at the context you work in. For example, the school may limit the practice time of the basketball team, but it may offer practice time for track and field that your players could utilise.

Second, consider if it's possible to do something to change the upper scales for better. Once again, this could mean widely different things depending on your context.

Maybe you should become a board member of your club. Or start a fund-raising campaign. Buy a share of the club. Found a club of your own. Build a basketball gym inside an abandoned ware house.

6.17 Always Assess Coaching in Its Context

Almost all media attention is geared towards a small portion of basketball: NBA, Euroleague, NCAA men's D1, Olympic games, national men's leagues. This makes us forget how varied the coaching contexts actually are. For example:

1. Diana is an NBA head coach. She has an army of assistants to run a practice for a dozen millionaires in a state-of-art facility.
2. Elina coaches twenty eight-year-olds on an outdoors court where there is no rim at the other basket. It's starting to rain. She is the head coach simply because she has no assistants.

How can you tell whether it's Diana or Elina coaching more effectively?

When put this way – explicitly – the question should sound absurd. Certainly you can't tell. The two coaches' performances can't be compared because the contexts are so different.

Yet implicitly, we tend to ignore this. Implicitly, we set the criteria of effective coaching based on high-performance contexts. We may even say that the currently hot NBA or Euroleague coach is the best coach in the world.

You do better, Coach. Always assess coaching in its proper context. This regards your own coaching but also that of the others. Apply the relevant criteria – and only them.

Remember, there is no such thing as the best coach in the world, in the country, or even in your region. Rather there are coaches doing more or less effective jobs in wildly varied contexts. The publicity they meet says close to nothing about their effectiveness.

CHAPTER 7: Practice Tasks or Drills

These practice tasks – often referred to as drills – are designed to add variability to practicing. Put in other terms, coach should consider enhancing the degree of novelty and the degree of creativity of her team's actions. (Chapter 5.4)

The drills have a lot to offer even if you don't the theoretical assumptions behind them. But as mentioned in the foreword, improving coaching is more effective if those assumptions discussed and corrected if that's in order.

This is not a comprehensive list of drill that a basketball coach needs. Rather, these are examples of drills and their variations that are in accordance with the complex basketball coaching paradigm.

Also, the idea is to share drills and their variations that may not be all familiar.

Under any circumstances, coach should limit the number of drills he uses. That is because we don't want spend time teaching drills to the players. Rather, we want to spend our time teaching them basketball.

To do that, it's more efficient to have few drills and many variations rather than many drills.

The drill descriptions demonstrate how I interpret the theory of CBC. Coach, feel free to make your interpretations. The idea of CBC is still newish, and we are just beginning to realise how basketball could be coached and played.

7.1 Scrimmage

- Playing 5v5 competitively – or scrimmaging – full court is the default practice task. (Chapter 6.1)
- There are numerous ways to add to the variability of scrimmaging. These are some examples below.
- The same variations may be applied to small-sided games.
- In any case, it is important that coach will not stop the action in the middle of a possession even if things don't go as planned.
- That is because when things don't go as planned, emergence happens. And emergence is exactly what we want to prepare for. (Chapter 6.7)

  1. Shorten the shot clock to emphasise transition offense and defense.
  2. Give the ball back to the scoring team to emphasise half-court play.
  3. Use a rim deductor at one end of the floor to create an advantage for the other team.
  4. Use rim deductors at both ends of the floor to emphasise rebounding and the accuracy of shooting.
  5. Use the game clock and scoreboard to create different end-of-game situations.
  6. Give four points for a three-point shot to emphasise three-point shooting on both offense and defense.
  7. After a score, allow the defensive team to transit to offense as after a rebound, or without inbounding the ball. This should quicken the pace.

7.2 Full Court 1v1 Plus Two Extras

- There's an offensive player, a defender, an offensive extra and a defensive extra.
- The offensive extra inbounds the ball baseline out-of-bounds.
- The offensive player attacks full speed end to end.
- Anytime the offensive extra raises her hands, the offensive player must pass to her.
- The defensive extra provides help and protects the basket and may double the ball anytime she chooses to.
- The play ends is the defender gets a steal.
- To end the play, the offensive player tries to score.
- Variations to the drill:
  1. Use a shot clock of for example 12 seconds.
  2. End with a 2v2 pick-and-roll play.
  3. The pick-and-roll action may only start after the ball handler has brought the ball to a certain spot on the floor and made the play call.
  4. Follow with another possession where the defender gets the ball and attacks.

7.3 Full Speed Attack 1v1 / 2v2

- Transition drill played full court 1v1 or 2v2.
- Offensive player and defender start at a designated spot.
- The action starts when coach throws the ball to the offensive player.
- She has eight seconds to score.
- The starting spots are changed continuously to vary the action.
- May be played 2v2.
- The drill may be varied in multiple ways:
  1. Add extra passer to help the offensive player(s).
  2. Add weak side defender to contest lay-ups.
  3. Shorten the shot clock to six seconds.
  4. Add a second possession: when the defense gets the ball, they attack the other way.
  5. The number of passes and/or dribbles may be limited.

7.4 Six Trips

- Put together a long list of different types of lay-up finishes and passes to be used.
- Lay-up constraints include shooting with the off-hand, shooting only reverse layups, and finishing with an alley-oop. For more constraints, see Appendix 1.
- Passing constraints include passing behind the back, between the legs or always putting a spin on the bounce pass. For more constraints, see Appendix 2.
- For one particular practice, choose one type of a lay-up finish and two types of passes (Pass 1 and Pass 2).
- Only that lay-up finish and those passes will be used in the drill that day.
- Rotate constraints from day to day.
- Divide players into pairs.
- Each pair will go down the floor six times. They will pass the ball back and forth and score.
- First trip down the floor: No defense. Use exclusively Pass 1.
- Second trip: Insert defense (assistant coach or player). Use exclusively Pass 1.
- Third trip: No defense. Use exclusively Pass 2.
- Fourth trip: Insert defence. Use exclusively Pass 2.
- Fifth and sixth trip: Insert defense. Use only Passes 1 and 2. After using one of the two, the player must use the other one.
- Variations to the drill:
     1. Vary the number of trips down the floor.
     2. Vary the number of the defenders.
     3. Vary the intensity of the defense.
     4. Vary the spacing and the tactics of the defenders.
     5. Vary the number of offensive players in a group.
     6. Vary the number of passes that must be made.

7.5 Two-Line Lay-ups With Two Extras

- A lay-up finishing drill for 6–12 players at one basket.
- The drill is run much like the regular two-line lay-up drill.
- A line of 3–6 players at midcourt on both sides of the floor.
- The players on the left side have a ball. They are the shooters.
- The players on the right side don't have a ball. They're the rebounders.
- The first players in the shooter line goes for a lay-up.
- After shooting a lay-up, the shooter plays defense on the next shooter, and only then goes to the rebounding line.
- The defense is varied: sometimes trail the driver, sometimes try to take a charge, sometimes go for the steal, and so.
- The next rebounder in line serves as an extra offensive player. If she raises her both hand, the shooter must pass the ball to her.
- The pass receiver variates where she is: she may cut to the basket, spot up in the corner and so on.
- Also vary where the lines are located: in the corner, in the wing, and so on
- If the skill task will eventually be learned with both hands, start doing it with left hand. [Stöckel et al 2011]

7.6 Mimic the Lay-up

- A lay-up drill to add movement variability.
- Collect clips of variable lay-ups used in games.
- On the practice floor, show the players a clip of a lay-up.
- Put in some extra defender(s) and have your players mimic the lay-up.
- Variations:
  1. Instead of using a clip, have a player demonstrate a lay-up for the others mimic.
  2. Film one round of lay-up attempts and have the players vote who did the best job of mimicking.
  3. Use the same method to any technical aspect of the game (e.g. jump shot).

7.7 Five Close-outs 1v1 / 2v2

- Scoring and close-out drill at one basket either 1v1 or 2v2.
- Five shooting spots: two corners, two wings, and the middle.
- In the 1v1 variation, for the first shot the shooter starts at a corner spot.
- The defender has the ball under the basket inside the no-charge semi-circle.
- The defender makes a crisp, direct pass to the shooter, closes out and plays defense. No bounce passes are allowed.
- The shooter may either take a shot right off the catch or use one dribble and then shoot.
- A basket gives the shooter two or three points, depending. So does a shooting foul. And one gives an extra point. All non-shooting are two points.
- No rebounding takes place. Each play ends after the first shot.
- For the second shot, the shooter rotates to the next spot, and so on, until she has taken one shot from each of the five spots.
- Then the shooter and the defender switch parts.
- Whoever scores the most points per round, is the winner.
- For the next round, the losers from each basket rotate to the next basket, and the winners stay at the same basket.
- In the 2v2 variation, the passer is one spot away from the shooter – say if the shooter is in the right corner, the passer's in the right wing.
- As the passer passes to the shooter, the shooter's defender closes out and the play starts.
- The shooter will either finish the play or pass the ball back to the passer who then must finish the play.
- There's a defender on the passer, too.
- Otherwise the rules are the same as in the 1v1 version.
- The drill can be varied in multiple ways and combinations of them.
  1. Include rebounding: continue play after the first shot.
  2. Change the defenders' starting posture.
  3. Move the passer to the weak side: start with a skip pass.
  4. Include extras: passer and/or help side defender.

7.8 One Plus One Is Four

- A shooting drill for two players at one basket.
- There's a rebounder and a shooter. That's the "one plus one" part in the name of the drill.
- You have one or two pairs at each basket.
- The shooter starts from close to the basket.
- After making two shots in a row, she moves one step further away.
- To add variability to the drill, the shooter shoots each and every shot from a different location. In other words, even while keeping the distance basically the same, she changes the angle and the distance a little.
- After passing the ball to the shooter, the rebounder may raise her hands. That's a signal to the shooter: instead of taking a shot, she passes the ball back to the rebounder, relocates, receives another pass, and shoots (unless the rebounder raises her hands again).
- This makes the "one plus one" equal three: the rebounder is a pass target, too.
- The rebounder may also follow her pass and play defense on the shooter. This makes the "one plus one" equal four.
- Additionally, you have one or more extra defensive players moving from one basket to another. These extras may be for example coaches or parents.
- The extra defenders may close out on the shooter and either pressure her shot or make her drive. Or, they may play the passing lane, so that even if the rebounder raises her hands, the shooter shouldn't pass the ball to her.

7.9 Zero One Two Three Four Plus

- Shooting competition with a shooter and a rebounder. Also for practicing free throws.
- Coach designates a set of shots that must be made in a row for the win.
- The codes:
  - 0 = Close-range two-pointer
  - 1 = Free throw.
  - 2 = Mid-range two-pointer.
  - 3 = Three-pointer.
  - 4 = Long-range three pointer (7.75 meters).
- For example: 2113 = Mid-range two-pointer, two free throws and a three-pointer.
- If there's a miss, the shooter must start from the top.
- If there's a plus in the call, the rebounder becomes the shooter after the plus.
- For example, in 2113+11 the rebounder must make two free throw to win the competition.
- Whenever possible, it is advisable to do the same or transform drills "from individual to team competitions". [Cooke et al 2013]
- This may increase "performance, enjoyment, anxiety, and effort". [Cooke et al 2013]

7.10 Five Arches, Six Basket

- A shooter and a rebounder at a basket.
- The shooter is to make six baskets using five different arches.
- The arches have numbers:
    - 1 = As low as possible
    - 2 = Moderately low
    - 3 = Regular
    - 4 = Moderately high
    - 5 = As high as possible.
- The rebounder calls out a number and the shooter must hit a shot using that type of an arch.
- So, when the rebounder calls "One" the shooter must shoot using as low an arch as possible.
- She keeps shooting using a low arch until she makes one. Then the rebounder calls another number.
- Each set starts and ends with a Three arch.
- All other numbers are used once, so the total number of makes is six.
- Set may be for example: 315243.
- Within each set, stick to about the same distance. That's because the emphasis should be on varying the arch, not the distance.
- You may variate the distance from set to set

7.11 Seven Baskets

- This is a differential learning shooting drill.
- A pair, a ball and a basket.
- The shooter shoots from three different distances: from 3 meters, from 5 meters, and last from beyond the 3-point line.
- Before moving further, she needs to make two differential shots from the spot.
- From beyond the three-point line, the player must make three shots: first the two differential ones, and then a regular one to finish the game.
- The two differential shots are different from each other.
- The coach determines the constraints, or what types of shots are to be made.
- Both shots may be of the differential kind, or the first one is regular.
- Before the practice, the coach has picked a constraint or two constraints to be used that day.
- The constraints may include:
    1. Release late / early
    2. Twist shoulders left / right
    3. Eyes open / closed
- For more constraints, see Appendix 3.

7.12 Coast to Coast on Demand

- This is a ball handling and passing drill.
- All players have a ball and they dribble baseline to baseline.
- If there are ten players for more, split the group in two.
- Additionally, there are multiple extras on the floor. They're assistant coaches or players who take turns as extras.
- Head coach directs the action by hand signals and verbal calls.
- Hand signals direct the direction and speed of the dribble.
- The more fingers are up, the quicker the dribbler dribbles forward.
    - For example, fist means "Stand still"
    - One finger = Walk forward
    - Five fingers = Full steam ahead.
    - If the head coach points one finger at the players, they retreat.
- The head coach's verbal calls direct the dribble.
    - For example, "Cross" means that players cross the ball over.
    - Back = Behind the back
    - Legs = Across the legs
    - Spin = Spin
- Additionally, at any point an extra may call out a player's name.
- Right away, the player in question passes to the extra and immediately gets the ball back.
- Extras also put defensive pressure on the players.
- Some of the extras may be designated passers, some defenders, or all may do both.
- Ways to vary the drill:
    1. After passing to an extra, the dribbler cut hard to the basket, gets the give & go pass and scores on a lay-up. The extra follows her pass and rushes to contest the lay-up.
    2. To utilise differential learning, constrain the passing and have players use a differential way to pass as in drill Six Trips (Chapter 7.4). For constraint options, see Appendix 2.
    3. To utilise differential learning, constrain the dribbling and have players use a differential way to dribble. For constraints, see Appendix 4.

7.13 Trampoline Alley-oops

- Above we concluded that "only those techniques can be used that can be actualised through the players' physical capabilities". (Chapter 4.2)
- But maybe some missing physical capabilities can be compensated for, for the sake of practice.
- For example, alley-oop passing and finishing can only be practiced once at least one player can jump high enough to dunk off an alley-oop pass.
- Lack of jumping ability could be compensated for by jumping off a trampoline.
- The drill could be a team competition at two ends of the floor.
- Whichever team finishes most dunks out of ten attempts is the winner.
- According to the specificity on learning principle, this drill would certainly teach the players to finish trampoline alley-oops and to throw alley-oops passes to dunkers jumping off a trampoline.
- But would these skills later transfer to actual alley-oops where the dunker jumps off the floor? They just might.

CLOSING WORDS: Your turn, Coach

We set out to find out what kind of a coaching paradigm optimises the effectiveness of basketball practice. Hopefully, we have now answered that question at a general level.

However, coaching is a context sport. All general teachings must be applied to concrete, forever-changing, wildly different situations.

When applied correctly, the complex basketball coaching paradigm assists you with in this application process. CBC helps you to consider the complex systems of different scales around the team.

Yet eventually it's up to you to find out what to do.

I'm not sure if it's comforting or discomforting, but you won't find the right answers. That's because a basketball team is complex system, and in complex systems it's impossible to know what the output will be. Thus there are no "the right answers".

All you can do is train, instruct, and teach your team in order to optimise its proficiency at manipulating the conflict in games. If you keep doing this job for long enough and stay alert, you'll get better.

The answers presented here are definitely not final. I may revise the book based on new findings and ideas.

Also it would be interesting to look more deeply into some questions only touched upon here. These looks could be writings about the mental dimension, about the physical dimension, about building offensive team tactics in accordance with complex basketketball coaching paradigm, and so on.

If somewhere along the ride some fundamental question begins to bother you and you think I might be able to help, e-mail me at harrimannonen@hotmail.com.

APPENDICES

Appendix 1: Lay-up finish constraints

- For more variation, come up with constraints of your own.
- Or combine two constraints. For example: Off-handed off high glass
- Or combine three constraints. For example: Off-handed off high glass with extra spin.
    1. Don't use glass
    2. Bank lay-ups only
    3. Bank lay-ups high off the glass
    4. Bank lay-ups with extra spin
    5. Reverse lay-up
    6. Finish with off-hand
    7. Alley-oop = Catch and shoot while airborne
    8. Use one hand only after receiving the pass

Appendix 2: Passing constraints

- For more variation, come up with constraints of your own.
- Or combine two constraints. For example: Jump for bounce pass.
- Or combine three constraints. For example: Jump for bounce pass with extra spin.
    1. No dribbling
    2. Behind the back
    3. Between the legs
    4. Hook pass
    5. Scoop pass
    6. Wrap around pass
    7. Bounce pass
    8. Bounce pass with extra spin
    9. Use one hand only after receiving the pass
    10. Jump pass
    11. Catch and pass while airborne

Appendix 3: Shooting constraints

- For more variation, come up with constraints of your own.
- Or combine two constraints. For example: Jump left + release late / Jump right + release early.
- For more constraint ideas, see the Master's thesis by Konttinen and Kuokkanen [2015]
    1. Release late / early
    2. Jump forward / backwards prior to the catch
    3. Lean in / fade
    4. Twist shoulders left / right
    5. Move the off-hand left / right
    6. Off one foot: left / right
    7. Ball rotation inward / outward
    8. Eyes open / closed
    9. Start the shot with legs crossed – left / right foot in front
    10. Start the shot with left / right hip pointing towards the basket

Appendix 4: Dribbling constraints

- For more variation, come up with constraints of your own.
- Some constraints are extremely difficult to obey in this context.
- For example, how do you dribble behind your back while holding elbows in contact with the side of your body?
    1. Hold elbows in contact with the side of your body.
    2. Keep elbows fully stretched.
    3. Keep your wrist rigid.
    4. Dribble with right hand on the left-hand side of the body and vice versa.
    5. Dribble with the ball extremely wide to the side.
    6. Dribble with the ball extremely much ahead of you.
    7. Dribble with the ball touching the floor left behind your hips.
    8. Put spin on each dribble.
    9. Use only the off hand.
    10. Touch the ball only at the knee level.

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- Purchasse the e-book for all your coaches and other staff.
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- Translate the e-book to your language.
- Have Mannonen do coach education based on complex basketball coaching.
- Adapt the principles of complex coaching to an invasion team sport other than basketball.