Summary
This chapter discusses current models and paradigms of tactical creativity in sports to give a theoretical framework for performance analysis of creativity in sports. After definitions, different components of creativity and the role of different types of play/practice in developing creativity are listed. Then possible assessments to evaluate creative behaviour in team sports are described. Here, a detailed comparison between video tests and game test situations of creativity is presented. This chapter is enclosed by different factors (attention, motivation) which influence tactical creativity in team sports.

Introduction
One of the world’s best soccer players, Lionel Messi, is able to make decisions in specific soccer situations which are unexpected and therefore less likely to be anticipated by his opponents. Creative solutions are of crucial importance in all team sports. By means of creative, unexpected solutions, basketball, soccer or team handball players are more likely to set up their teammates’ shots on goal.

Since the work of Guilford (1967), the systematic scientific examination of creative processes has become an established part of psychology and has delivered important results in various contexts, such as science, literature, music, art, religion and politics (for an overview, see Runco, 2007). In sport sciences, the notion of creativity has come to play an important role in sport didactics, sport pedagogy, movement science, dancing science and sport psychology in the last few decades.

Without being able to delve into the history of creativity research in any more detail (overview by Runco, 2007), one must give special consideration to the work of Robert J. Sternberg. In his integration model ‘investment approach to creativity: buy low, sell high’ (Sternberg and Lubart, 1991, 1992, 1995), he succeeded in uniting different theoretical designs into one draft framework (see Figure 24.1). This includes the componential theory by Amabile (1983), the systems approach by Csikszentmihalyi (1988), the synectic model by Gordon (1961), as well as the ‘triarchic theory of intelligence’ by Sternberg (1985). Beyond this, it incorporated patterns of results from studies on personality (Barron, 1965), problem solving (Getzels and Csikszentmihalyi, 1976), creative styles (Kirton, 1976), as well as different environmental influences (Simonton, 1988).
As shown in Figure 24.1, the authors distinguished four different levels in their model: interacting resources, domain-specific ‘creative’ abilities, a portfolio of ‘creative’ projects and assessments of the ‘creative’ products. Originally, the model aimed to depict the creative process from start (required resources and abilities) to finish (assessment of the product).

Sternberg and Lubart (1991) initially postulated six resources (R_1–6), which are assigned to the three areas of cognition (intelligence, knowledge), affective–conative factor (personality, motivation) and environment, in which ‘intellectual styles’ are regarded as a ‘mixed resource’ between the first two categories. Sternberg and Lubart (1991: 5) assumed that all resources are connected with each other in a complex way and depending on the given task in the generation of domain-specific creative solutions (level 2; C_1–n). In a first multivariate validation study (N = 48), the authors showed that the five resources – the environment factor was not taken into account – give a sufficiently exact prediction of the creative performances (as in the sum of scores from drawings, stories, scientific problem solving, etc.), with a multiple correlation coefficient of $R = .81$. The measurement of the cognitive and affective–conative resources was conducted by means of an extensive test battery (for more details, see Sternberg and Lubart, 1991), with fluctuations in the intercorrelations of the predictor variables of between .09 and .68.

The importance of tactical creativity in sports seems to be increasing due to coaches’ ability to collect more and more information about their opponents. For example, by means of game observation and game analysis, it is possible to study the individual tactical behaviour of players (e.g. feints and defensive behaviour in one-on-one-situations), the tactical interaction of a group of players (specific combinations in the offensive or defensive) and the general game strategy of a team (e.g. using more counter-attacks, double-teaming players).
Tactical creativity

Definition of creativity

The fundamental point of the research group of Guilford was the separation of two different cognitive thinking processes, which were later picked up by team sport research, too (Memmert and Roth, 2007). While convergent thinking processes aim for so-called ideal solutions for problems, divergent thinking processes try to generate a variety of new and not necessarily self-evident solutions. For team and racket sports, two different cognitive thinking processes can be discriminated: tactical game intelligence and tactical creativity.

- **Tactical game intelligence (convergent tactical thinking):** in team and racket sports, tactical game intelligence is understood as the production of the best solution for specific individual, group or team tactic match situations.
- **Tactical creativity (divergent tactical thinking):** in team and racket sports, tactical creativity is understood as the generation of a variety of solutions in specific individual, group and team tactic situations which are surprising, seldom and/or original.

This classification also corresponds to the consensus of coaching textbooks in sports supporting the balance between planned behaviour and improvised creative behaviour (Reilly, 1996; Smith and Cushion, 2006).

For the operationalization of tactical creativity, three different characteristics are often used, namely originality, flexibility and fluency, which Guilford and his research group identified by means of factor analysis in 1967.

- **Originality:** the exceptionality of tactical solutions can be rated by experts.
- **Flexibility:** the variety of tactical solutions is determined by the diversity of actions/answers of the test persons.
- **Fluency:** the number of tactical solutions that test persons generate for a specific match situation.

In differential psychology, there is a multitude of studies that are concerned with the correlation between divergent and convergent cognitive thinking performances (for a review, see Runco, 2007). For the explanation of variance between 20 and 30 per cent, there is a controversial discussion of different models. The threshold hypothesis assumes that high intelligence is not identical to according creativity but rather a prerequisite for high creativity. The first field studies in team sports support the current trend of psychological studies and therefore do not confirm the threshold model. New data, however, have identified positive correlations between both cognitions (between .36 and .71; see Memmert and Roth, 2007). A higher game intelligence indeed seems to go hand in hand with a higher creativity value. So far, there are almost no examinations which trace the development of tactical creativity in sports. A first cross-sectional study (peer group: 7, 10 and 13 years) suggests that children do not follow a linear development (Memmert, 2010b). Whilst there are significant improvements in tactical creativity from the age of seven until ten, there seems to be stagnation after that. Findings from neuroscience support these assumptions because both the absolute number of synapses and the density of synapses reach their maximum at this age (Bekhtereva et al., 2001).

From a methodological point of view, there are generally two ways of training tactical intelligence and tactical creativity:
‘Deliberate play’: the uninstructed and free operation in game-oriented, unstructured situations.

‘Deliberate practice’: the instructionalized operation in routine-centred, structured situations with the aim of effectively improving specific individual performance criteria.

Evidence from children and youth sports provides a basis for a convergence of the two prevalent research programmes (expertise research, creativity research) that have not been discussed in the same context yet. Both results suggest that practical experiences and early play are important influences on the development of creativity in sports. In this case, specific experiences (such as deliberated practice) over a long period of time (ten-year rule) are necessary for the attainment of expertise (e.g. Helsen et al., 1998; Kalinowski, 1985; Monsaas, 1985). At the same time, current theoretical approaches and empirical research regarding the development of creativity (Csikszentmihalyi, 1999; Kurtzberg and Amabile, 2001; Martindale, 1990; Milgram, 1990; Smith et al., 1995; Sternberg and Lubart, 1995) support the view that gathering diversified and even non-specific experience (such as deliberated play) over years is an ideal medium for the development of creative thinking.

By means of an experimental field study (treatment: 18 real training sessions of youth players) in the sport of basketball, Greco et al. (2010) were able to show that a deliberate play training programme leads to greater improvements in both convergent and divergent tactical thinking than the training of a control group. Whilst the deliberate play group operated in relatively unstructured majority/minority situations (1 × 2, 2 × 3 and 3 × 4) or situations with a neutral player (1 × 1 +1, 2 × 2 +1, 3 × 3 +1 and 4 × 4 +1), the control group practised traditional, basketball-specific routines according to precise guidelines (Lumsden, 2001). Further empirical research is missing which shows that creativity is trainable in later stages of player’s development (e.g. adult training scenarios).

Tactical creativity tasks

Whilst physical parameters such as distances covered or performed speeds are easy to analyse, tactical parameters or even creativity are much harder to evaluate in team sports. On the one hand, game observations are performed under field conditions and have therefore very high ecological validity (Leser, 2006). On the other hand, however, due to the high number of confounding variables (e.g. daily constitution of players, pitch conditions, opponent’s influence), the internal validity is very low. Thus, the method of observation is the less common diagnostic instrument to assess the creative performance of players in team sports.

In psychology, usually test procedures are used in which all possible ideas and solutions which come to one’s mind for a task must be named (for an overview, see Runco, 2007). For example, a subtest of the well-known divergent thinking test for pre-school and school children involves giving them a pen and a sheet with 24 ovals (Krampen, 1996) with the instruction to give their creativity free rein and draw in the ovals anything that comes to mind. The children’s performances were judged using the three above-described observation criteria of originality, flexibility and fluency. Two independent expert coaches judged the unusualness and innovativeness of the solutions for each sheet. For flexibility, all suggested solutions were classified into 18 different categories (e.g. fruit, vegetables, animals, people, food, toys, vehicles, etc.). Fluency was measured by the number of ovals that a subject submitted per sheet.

The tests developed for the evaluation of tactical creativity in sports go in the same direction and can be classified into two different categories (see Table 24.1). These include ecologically valid game test situations and relatively high-standardized specific tactical creativity tasks.
Tactical creativity

Video test

Video tests capture the individual components of creative performance under standardized conditions. The test persons are given cognitive tasks with special demands and are asked to answer based on their best outcome. For example, in relatively high-standardized specific tactical creativity tests, athletes have to view brief video sequences of a sport game (e.g. basketball, soccer) in which, for example, attacking players play against defending players (see Figure 24.2b). At the end of each clip, the image was frozen for a period of time. The players had to imagine themselves as the player with the ball and had to name all opportunities that may possibly lead to a goal. The motor executions (e.g. pass with the non-dominant hand, indirect pass) could also be mentioned here. The experimenter noted the players' answers on a specially designed sheet which contained all appropriate tactical decisions. All participants had to view several (up to 30) sport-specific video scenes.

The above-described observation criteria of originality, flexibility and fluency are usually used for the athletes’ performances (see Charles and Runco, 2001 for a similar procedure in general creativity measurements). For example, the assessments of the judges could be varied between 1 (= not creative at all) and 5 (= very creative) for each tactical decision and for each of the video situations, respectively. For flexibility, all possible tactical decisions in each situation could be categorized into different solution options (e.g. perform a one-on-one action, shoot at goal with jump throw, no-look-pass and pass with a feint). One point could be given for each larger category selected by a subject for the video sequence. The precise number of (appropriate) answers given by a subject for each video scene could finally be used for fluency.

By means of creative tests, also specific and isolated subcomponents of creativity can be measured, controlled and repeated. However, very often video tests fail practical relevance and the isolated attendance of creative demands does not ensure their appearance in more complex situations (Memmert, 2011).

Game test situations

Game test situations are able to study human behaviour in natural, complex and ecologically valid situations of team sports. They contain a context-dependent, real-world setting which can directly provoke creative behaviour in recurring comparable situations. This new idea has been

<table>
<thead>
<tr>
<th>Label</th>
<th>Task</th>
<th>Authors (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game test</td>
<td>This instrument contains a context-dependent, real-world setting that can directly provoke tactical tasks in ecologically valid situations. Participants’ tactical behaviour is recorded on videotape and their tactical decisions are analysed by expert coders using a subsequent concept-oriented expert rating system (criteria: originality, flexibility).</td>
<td>Memmert (2006, 2007, 2010a); Memmert and Roth (2007)</td>
</tr>
<tr>
<td>Video test</td>
<td>In this decision task, participants watch sport-specific videos. The image is frozen after one minute. The participants have to imagine themselves as the acting player and name all opportunities that might possibly lead to a goal. The answers are evaluated according to the criteria of originality, flexibility and fluency.</td>
<td>Johnson and Raab (2003); Memmert (2010b)</td>
</tr>
</tbody>
</table>
extensively described by Memmert (2011) in a chapter of the Encyclopedia of Creativity (Runco and Pritzker, 2011).

Game test situations are simple forms of game play with clearly defined playing conditions and rules as well as specified numbers of players. The basic idea and the rules are determined so that a high number of specific tactical situations can be induced without standardizing the actions of the participating players (Memmert and Harvey, 2008). Therefore, the most essential properties of game sports survive (e.g. the interaction process between and the game goal of the different parties, as well as the game idea). Also, the tactical abilities of interest emerge more or less isolated and in an adequately high number so that the performance can be assessed. Game test situations involve different kinds of motor skills (e.g. hand, feet, hockey stick) in a system where players take turns (two rounds for each person). Therefore, positions and players/opponents can be systematically varied.

For example, in the game test situation ‘making use of gaps’, the pitch is separated into three different, smaller fields (see Figure 24.2a). There are two children in each of the outer fields and three in the central field. The pairs in the outer fields have to pass the ball to each other with their hands without entering the central field and without letting the defending team get ball possession. The defending team must avoid passes and is also not allowed to leave their field. The pitch is limited by gym mats on both sides and a rope above the central field. If the children do not find any gaps, they have to pass the ball to their team member.

Memmert (2007) used concept-oriented expert rating systems for the evaluation of the tactical creativity of players in game test situations (see Figure 24.2c). For example, the characterization of the tactical element ‘making use of gaps’ stands for the demand for spatial decision making in match situations in which gaps are used adequately. Therefore, it has to be assessed whether or not the children have found the optimum gap. The technical execution of the passes is not evaluated. Experts in a particular team game have to evaluate all the children’s actions according to the above-mentioned characterizations. The assessment is based on a scale which has been validated by external experts and which the evaluators got to know by means of a multitude of exemplary video sequences.

For the future, game test situations seem to be particularly interesting for children and youth training (diagnostics of development and talent) and the evaluation of theories of training tactics.

**A detailed comparison between video tests and game test situations**

Table 24.2 gives an overview of specific possibilities and limits of both approaches (video tests vs. game test situations). All in all, the video tests are definitely less complex (e.g. stimuli, response options, etc.) than the game test situations. Distinct advantages of the video tests are the clear test situations in the video sequences so that almost no confounding variables (e.g. conditional or technical factors) appear. In contrast, the performances in game test situations are always confounded with partial performances of the test persons. For example, motor skills interact with tactical solutions. Of course, the technical skills of a player have an influence on the solution of tactical situations. This has to be avoided so that one does not unconsciously assess the observed motor performances of the test person but exclusively concentrates on the expected tactical actions of the player. The observation of motor actions for the assessment of tactical actions is technically possible in videos, too, but it is rarely used and applicable only to some extent. In game test situations, however, the motor–action coupling is given by nature.

At present, the interactivity with the medium of the huge screen is quite low for most of the published approaches; in contrast, the interaction between offensive and defensive players
Originality of solutions to the situation (using gaps or passing) | Flexibility in the solutions to the situation (using gaps or passing) | Scaling | Anchor examples
---|---|---|---
Way above average (very unusual) | Two or more (different, original actions) | 10 | The subject demonstrated different, highly unusual solutions to situations. The gaps and passes found were absolutely unique.
Way above average (unusual) | Two or more (different, original actions) | 9 | The subject demonstrated different, unusual solutions to situations. Finding of gaps or passes were unique.
Above average (rare) | Two (different, original/rare actions) | 8 | The subject demonstrated different, still unusual solutions to situations. The gaps and passes found were very rare.
Average (rather rare) | Two (different, rare actions) | 7 | The subject demonstrated two different solutions to situations which were not unusual, but still very rare. The gaps and passes found were very surprising.
Average (quite rare) | Two (different, rare/new actions) | 6 | The subject demonstrated two different solutions to situations which were not unusual but rare. The gaps and passes found were surprising.
Just below average (still new) | One (rare action) | 5 | The subject demonstrated one solution to situations which was not the usual standard but which had already occurred. The gaps and passes found were still innovative.
Just below average (very little new) | One (new action) | 4 | The subject demonstrated one solution to situations which was not the usual standard, but which had already occurred often. The gaps and passes found were still innovative.
Below average (rather standard) | none | 3 | The subject generally offered standard solutions to situations which had been displayed often. The gaps and passes found were rarely innovative.
Way below average (almost all standard) | none | 2 | The subject almost exclusively offered standard solutions to situations which had all been displayed already. The gaps and passes found were very rarely innovative.
Way below average (only standard) | none | 1 | The subject only offered standard solutions to situations. The gaps and passes found were never new.

Figure 24.2 (a) Diagram of the game test situation ‘making use of gaps’ (pitch dimensions = 8 × 7 metres; width of the midsection = 1 metre; height of the line above the midsection = 1.50 metres; distance between video camera and pitch = 8 metres; Memmert, 2007, 2010); (b) videotest situation in team handball. Three defenders play against three offenders. The player in the middle, who cannot be seen during the test, would be the ideal solution in this match situation (Memmert and Furley, 2007); (c) Scaling for the evaluation of tactical creativity (Memmert and Roth, 2007)
as well as team members is always given in game test situations. The game test situations have a high authenticity regarding complex match situations, which is rather not the case for video tests due to their artificial set-up in a laboratory setting. Since they only assess isolated, partial performances, the results from the video tests can be transferred to practical exercise scenarios only to a certain extent. Game test situations, however, are of high practical relevance since the test persons operate in almost realistic field conditions.

Another advantage of video tests is that the selected video sequences can be chosen and adjusted to specific tactical decision performances. In game test situations, it is more difficult to provoke tactical actions of the test persons which then cause only one isolated tactical partial performance. For example, in the game test situation ‘making use of gaps’, running into space and asking for the ball is restricted by the fact that every player has their set position, which they must not leave. Another advantage of video tests is that, through tactical responses, the test persons are forced to react to many different comparable situations. This can only be set up adequately if the test persons operate in game test situations for a long period of time (ca. 15 minutes or more). By means of adequate, according video sequences, a high consistency and thus reliability of the examined material can be guaranteed. Due to the creation of natural conditions in game test situations, there will, despite a consistent formulation of tasks, always be a certain amount of variability, which can be optimized through an extension of the playing time in the game test situations (improvement of the reliability).

One advantage of video tests is that one can easily add further manipulation stimuli (e.g. inducing motivational focus or attention-directing instructions). Technically, this is possible for game test situations, too; however, it is harder to control. One variation is that the test persons must operate in different forms of motor actions (e.g. with hands, feet or hockey sticks) (Memmert and Roth, 2007).

### Creativity and attention

Several studies from psychology compellingly demonstrated that attention plays an important role in the generation of creative thoughts (for a review, see Kasof, 1997). These results will be discussed next with a link to practical implications in sport.

A broad attention focus is necessary in order to perceive unexpected objects, such as unmarked teammates, which could potentially be the starting point for original solutions (Furley et al., 2010; Memmert and Furley, 2007). Fewer instructions by the coaches imply an induction of

<table>
<thead>
<tr>
<th>Complexities</th>
<th>Video tests</th>
<th>Game test situations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Confounding variables (teammate, etc.)</td>
<td>Low</td>
<td>Middle to high</td>
</tr>
<tr>
<td>Motor-action coupling</td>
<td>Only middle</td>
<td>High</td>
</tr>
<tr>
<td>Interactivity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Authenticity of situations</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Transferability in practice</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>One-dimensional structure of tasks</td>
<td>Given</td>
<td>Nearly given</td>
</tr>
<tr>
<td>Density of relevant actions</td>
<td>High</td>
<td>Middle to high</td>
</tr>
<tr>
<td>Relative consistency of conditions</td>
<td>High</td>
<td>Middle</td>
</tr>
<tr>
<td>Experimental manipulations</td>
<td>High</td>
<td>Middle to high</td>
</tr>
</tbody>
</table>
a broad attention focus and lead to significantly better results in finding original and various solutions than for children who are constantly confronted with attention-directing instructions during training sessions (Memmert, 2007).

These findings support previous research on attention-narrowing environment stimulations (Dewing and Battye, 1971; Friedman et al., 2003; Martindale, 1999; Mendelsohn, 1976; Mendelsohn and Griswold, 1964, 1966; for a review, see Kasof, 1997), which found that, with a narrow breadth of attention, not all stimuli and information that could lead to original and possibly unique solutions in a certain situation can be taken in and associated with one another. A wide breadth of attention, on the other hand, makes it possible to associate different stimuli that may initially appear to be irrelevant. Considered together, the findings highlight the fact that the attention-broadening programme can play a useful role in promoting the development of creativity in children. This programme appears to be particularly suitable for achieving a wide breadth of attention during game play. Martindale (1981: 372) explains this fact as follows:

The more elements that a person can focus on simultaneously, the more likely it is that a creative idea will result. Why? Because the more elements that can be focused on, the more candidates there are for combination. Thus, with two elements – A and B – in the focus of attention, only one relationship – AB – can be discovered. With three elements – A, B, and C – there are three potential relationships – AB, AC, and BC – to be discovered. With four elements, there are six potential relationships, and so on.

In general, coaches have two options to influence the breadth of attention of their players: (1) direct, by means of instructions or (2) indirect, by inventing routines, exercises and game variations which provoke a broad attention focus of the players.

There are two aims of the training: one is the coach’s help by naming different solutions to certain situations. More important, however, is that, through a reduction of instructions, the children are given the possibility to find unexpected, possibly better solutions on their own.

The perception and operation in many different team and sport game situations has a positive influence on the development of tactical creativity (Memmert and Roth, 2007). Movement biographies of professional ball sport players indicate that creative players, as opposed to less original ball sport players, (a) had the opportunity to try and practise various different sports in their childhood, (b) were able to experience movement in different team game-related situations, (c) operated in many relatively unstructured (complex) team game situations (‘deliberate play’) without instructions and (d) had participated over a long period of goal-oriented training in their main sports (‘deliberate practice’).

Important for the generation of original solutions is that children start to experience different ball sports at an early stage. In the frame of a variety of game forms, they learn to play with all sorts of balls by means of their hands, feet, tennis rackets or hockey sticks. This way, they are forced to think through different game situations in many different and new ways. Therefore, the training and fostering of tactical creativity by means of ‘deliberate play’ and ‘deliberate practice’ must be considered when coaching beginners and promoting talents.

**Creativity and motivation**

The amount of studies from psychology fascinatingly displays that instructions which provoke a happy mood can forward creative performances (for an overview, see Isen, 2000), stimulate the production of innovative ideas (Isen et al., 1987) and further the generation of unusual free
associations (Hirt et al., 1997). In addition, to improve divergent performances, for example, it is sufficient for participants to be instructed, whilst working on established creativity tests, to press their hand against the table top from below (crook of arm) and not from above (straight arm; Friedman and Förster, 2000).

Different kinds of motivationally oriented theoretic models from social psychology explain why creative performances can directly be influenced by the simplest of instructions – for instance, manipulating emotional states of the participants (‘regulatory focus theory’, Higgins, 1997; ‘theory of personality systems interactions’, Kuhl, 2000). Higgins (1997) proposed two modes of self-regulation, in order to regulate pleasure and suffering (i.e. to direct behaviour towards promotion or prevention targets). More specifically, a focus on accomplishments and aspirations are labelled as promotion focus, and a focus on safety and responsibilities are called prevention focus. In addition, there is no a priori advantage of either motivational orientation in terms of performance. According to this approach, the performance on a given task may depend on the fit between people’s regulatory focus (promotion or prevention) and people’s chronic regulatory orientation (promotion or prevention; Higgins, 2000).

This idea of better performance and a more positive effect via regulatory fit has already received some empirical support in the domain of cognitive (e.g. Keller and Bless, 2006; Memmert et al., 2010) and even motor tasks (Plessner et al., 2009). Thus, such considerations seem to have the potential for optimizing divergent tactical performances by sport-specific motivational instructions (Memmert et al., 2012). On the other hand, it is desirable that sports science can, in ecological settings, make a contribution to the further development of motivationally oriented theoretic models from social psychology.

Concluding remarks

The term tactical creativity has been used poorly in performance analysis of sports in recent years and this chapter plays an important role in explaining the impact of creativity in performance analysis as it is in other disciplines, such as creativity research and sports psychology. This chapter has been very specific in explaining how creativity is defined and how it can be used for performance analysis in sports. Therefore, the techniques of different creativity tasks (video tests, game test situations) which can produce reliable and valid creative performance values in sport were introduced. In addition, specific possibilities and limits of both procedures to determine the level of decision making were considered. The interaction of tactical creativity with attention and motivation was also discussed: theoretically, empirically and practically. This is important because attentional and motivational processes play a considerable role in tactical creativity training and diagnostics in sport.

References


Tactical creativity


