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Ecological approaches to Sport Activity: A commentary from an action-theoretical point of view

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The objective of this paper is to comment on four ecological approaches to sport activity which are based on the conceptions of Urie Bronfenbrenner, Roger G. Barker, Egon Brunswik and James J. Gibson. Their consensual general message is that to sufficiently explain, predict and improve some behaviour it is necessary to study the objective properties of the environmental context in which this behaviour takes place. Concerning their peculiarities, it is shown that each of these approaches provides particular contributions to an extended theoretical understanding of sport activity. However, the most profit will be gained when focusing on their complementarities within an integrative frame of reference. In this sense, a promising perspective is provided by action theory. Action theory is designed as a systems approach to the person-environment interrelation, assuming that the human-specific core of this interrelation is the intentional organisation of behaviour within a meaningful situational context, i.e., action. It is shown that this perspective is capable to embody and interconnect central aspects of different ecological approaches according to their particular significance within the dynamics of situated action. The main focus, however, is on further differentiation of the organisation of action with regard to a comprehensive understanding of the psychological nature of the person-environment interrelation. The essentials of this conception are briefly outlined with special reference to the structure of action situations and the functional architecture of actions.

Introduction

The general intention of sport-psychological intervention may be considered as optimising performance, health and quality of life of sport participants. Attaining this goal in a systematic and responsible way with a sufficiently high probability of success and an amount of resources, effort and time as low as possible fundamentally depends on a sound theoretical basis.

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It is the merit of this IJSP-Special Issue and its editors doing justice to this fact by presenting *ecological concepts* which undoubtedly contribute to an extended theoretical understanding of sport activity which is urgently needed.

However, taking into account environmental properties and their interrelation to the characteristics of the acting person and his or her development and behaviour is not a new insight as such. Beyond the long-standing controversy over the 'heredity-environment problem', all of the 'great theories' in psychology – e.g., phenomenological psychology, psychoanalysis, behaviourism, gestalt theory, cognitive psychology, humanistic psychology – principally refer to this aspect. What is comparably new is shifting the *focus* of theorising, empirical investigation and intervention from person to environment.

This is exemplary shown by the contributions to this Special Issue by Krebs related to Urie Bronfenbrenner's "bioecological model" (e.g., Bronfenbrenner, 1979, 2005), Kaminski related to Roger G. Barker's concept of "behaviour setting" (e.g., Barker, 1968), Hammond and Bateman related to Egon Brunswik's "probabilistic functionalism" (e.g., Brunswik, 1955; Hammond & Steward, 2001), and Fajen, Riley and Turvey related to James J. Gibson's concept of "affordances" (e.g., Gibson, 1979).

To say it in advance: While looking for applications to research and intervention in the field of sport, these authors more or less modify the background concept they refer to while emphasising particular aspects. Additionally, we have to take into account the fact of a relatively brief presentation of highly complex conceptions. Thus, it sometimes might be difficult to decide whether a missed aspect of potential relevance has been ignored on the whole or merely not reported.

In spite of great differences concerning details, all of the four presented conceptions are labelled "ecological". Supposing all of them were well-founded, the question would arise: What are the common features, and how far are the peculiarities to be considered as complementary parts of a more comprehensive picture?

To answer this question requires an appropriate frame of reference to evaluate and compare the conceptions at stake from the same point of view. The frame of reference applied here is threefold with regard to (1) the *constitutive components* of these conceptions; (2) their particular contribution to the solution of theoretical, methodological and practical problems in the *field of sport*; (3) their relation to a comprehensive understanding of human action, in particular provided by *action theory*.

Constitutive Components of the Ecological Approaches

General Aspects

As a guiding principle, psycho-ecological approaches share the basic assumption that to sufficiently explain, predict and improve some behaviour it is necessary to study the environment in which this behaviour takes place.[1] This has important consequences on all constitutive components of scientific investigation (see Figure 1) resulting in the following common features of theses approaches.

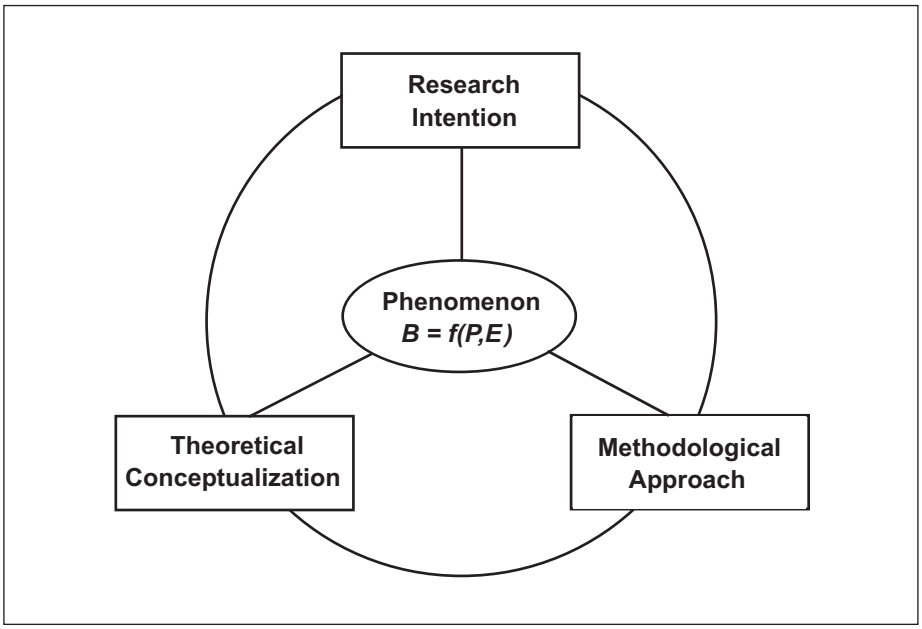

Fig. 1. Constitutive components of psycho-ecological investigations with respect to Lewin's understanding of behaviour (B) as a function of person (P) and environment (E).

[1] This idea is borrowed from evolutionary biology emphasising the "ecological world" instead of the "world of physics" (cf. Gibson, 1979, Introduction and chap. 1; Lewin, 1942, p. 217): Unlike biological (animate) systems, non-biological (inanimate) objects have no "environment" to cope with and adapt to. Methodologically, this perspective goes along with a shift from classic physics to modern physics, e.g., increasingly applying formal models from field theory and synergetics/dynamic systems theory. By expressing this orientation, these conceptions are labelled "ecological physics" (e.g., Shaw & Kinsella-Shaw, 1988).

The general *phenomenon* (subject matter) is best characterised by what Kurt Lewin told us already about 70 years ago (e.g., Lewin, 1936): Behaviour (B) is to be understood as function of *life space* which is constituted by person (P) and environment (E), expressed in the well-known formula: B = f(P, E). Some decades later, Urie Bronfenbrenner extended this equation by including the time perspective of development throughout the life course (see Krebs, in this issue).

There is also consensus concerning the general attributes of person, environment and behaviour. According to the wording of Bronfenbrenner (cit. by Krebs, in this issue), *person* is considered "as an active agent in, and on, its environment" involving changes in his or her properties depending on growth, learning and alterations in psychobiological state. Concerning the *environment*, it is not the physical world itself which is of primary interest, but – in analogy to the bio-ecological concepts of 'biotopes' and 'habitats' – "the way in which it exists for that person at that time" (Lewin, 1942, p. 217). Thus, the focus is not on elementary physical properties themselves but on dynamic "higher order" structures (Mace, 1977, p. 44) which are potentially relevant for the organisation of behaviour (and development), i.e., the "behavioural environment", a conception which can be traced back to Koffka (1935). Consequently, *behaviour* is – beyond a single molecular act or merely a reaction to external conditions – concurrently conceptualised as an adaptive molar and meaningful activity, i.e., action.

Corresponding to this understanding of the phenomenon as 'a dynamic person acting in and on a dynamic behavioural environment', the common features of *theoretical conceptualisations* can be summarised as follows. Instead of an elementaristic approach priority is given to a holistic or system perspective in more or less explicit reference to gestalt theory and field theory. In particular, this perspective involves emphasising dynamic functional *structures.* Thus, the intended scientific explanations do not refer to single causal relations between isolated variables but to functional interdependences within and between complex systems.

The implication for *methodology* is applying a "naturalistic" research strategy (see Kaminski, in this issue). However, this does not mean that experiments are to be abandoned in favour of field studies, or that the setting of an experiment should somehow represent "real life". The guiding principle is what Brunswik (1955) called "representative design". As Hammond and Bateman (in this issue) pointed out, the conditions under which the results of an investigation are obtained should "*represent the circumstances toward which the results are intended to apply*". This requires "making explicit the features" of the real situation the investigation refers to, i.e., to

describe precisely those environmental properties which are actually relevant for displaying the investigated behaviour under field conditions. At a first glance, this appears to be a basic requirement for experiments only (and in fact this was Brunswik's primary intention). However, it is also valid for field studies taking into account the problem of generalisation: Even in field studies the results are necessarily obtained from more or less selected persons and selected circumstances. Generalisation of observations then depends on what is actually considered as a 'prototypical person-environment interrelation' (e.g., catching an approaching ball under experimental conditions; a return shot in a tennis match, or a school lesson).

Finally, the understanding of the basic phenomenon and the general characteristics of theoretical conceptualisation and methodological strategy correspond to the overarching *research intention* of psycho-ecological approaches, namely to analyse the behaviourally relevant person-environment interrelation in order to optimise the person-environment fit as a general adaptive goal of any behaviour and behaviour modification as well. This involves three directions of investigation and intervention: (a) describing the given structures of environmental conditions and identifying and modifying the unfavourable ones; (b) analysing the behaviours which occur under these conditions; (c) making the person for him- or herself, if necessary, more sensible and adapted to those conditions by learning and training.

Specifications

Despite these common features of psycho-ecological approaches mentioned above, some important differences in specification concerning each element of Lewin's equation — person, environment, behaviour — as well as their interrelations still remain (including differences to Lewin's special understanding of theses elements as well). Accordingly, each of the ecological approaches under discussion can be characterised by its particular profile in specifying and balancing the four constitute components of scientific investigation shown in Figure 1. I cannot go into all of the details here but will only take up some of the most relevant ones in focusing on theoretical aspects.

The critical questions are: (1) Which kind of behaviour is considered in its relation to which kind of environmental conditions? (2) What is the assumed nature of this interrelation? (3) What follows from this concerning the properties of the acting person? Answering these questions may help to clarify, how far the obvious differences between the conceptions are due to

(a) differences in terminology; (b) different sections of the general phenomenon under study, or (c) alternative (competitive) explanations of the identical phenomenon. To say it in advance: All of these options come into play.

Bronfenbrenner's bioecological theory of development (Krebs, in this issue). Undoubtedly, the conception with the comparably broadest scope – concerning the range of environmental conditions, person's properties, person-environment interactions and time perspective – is provided by Bronfenbrenner's "bioecological theory of human development" (e.g., Bronfenbrenner, 2005). The leading idea behind this conception is to provide an appropriate scientific basis for effective social policies and programs which are urgently needed to promote, in particular, the development of disadvantaged children (see, for a well-known example, the US-national "Head Start" program, created in 1965). Applying a shell metaphor, person's environment is considered as a nested structure of four interconnected surrounding systems – formally denominated as "microsystem", "mesosystem" "exosystem", "macrosystem" – which are primarily defined in sociological terms. Individual development of the person as a whole is considered as to be dependent on (a) both objective and subjectively perceived properties of these systems, the systems' interplay, and transitions from one setting to another; (b) the properties of the person, including "biopsychological resources" (genetic potential and actual capabilities) as well as "directional dispositions", in particular, psychological characteristics of the developing person called "developmentally-disruptive" vs. "developmentally-generative". Beyond changes throughout the life course, special attention is also paid to a very important point concerning the developmental effectiveness of external influences, namely the "timing of biological and social transitions". With regard to theory, methodology and intervention, the main focus is (but not exclusively) on social interrelationships.

In summary, this conception is what it ought to be: a very fruitful frame of reference for developmental research and intervention. It offers a systematic description of the areas and factors influencing human development. Thus, it is primary a classification model but not a process theory, although emphasising organism-environment interactions by "proximal processes" as "primary engines of development" (Krebs, 2009). However, there is no precise information available, at least in Krebs' presentation, on how proximal processes operate in detail. Furthermore, the time perspective is mainly related to the present and past, the future orientation appears to be too neglected.

Barker's behavior setting concept (Kaminski, in this issue). While Bronfenbrenner's conception is focused on the conditions of development,

Barker's "ecological psychology" (cf. Barker, 1968) is narrower in scope emphasising the socially determined spatio-temporal context of *in situ* behaviour (see for details, criticisms and several extensions Kaminski, in this issue). Based on extensive observations of children's every-day behaviour and implicitly applying a casting mould metaphor, the essential point is that this context, called "behaviour setting", implies "programs" for "standing patterns of behaviour" irrespective of the concrete inhabitant of the setting. That is, the focus is on molar, individual-unspecific behaviours which are typical for particular settings (e.g., classroom). It is worth mentioning that this is also of high importance to explain characteristic alterations of an individual's behaviour across different settings.

The specific impact of a behaviour setting is investigated from an outside perspective of an external observer. Thus, the intentions of an individual and its active contribution to the modification of a setting or the constitution of new ones are not explicitly and systematically taken into consideration. Socially deviant or destructive behaviours are out of the scope as well.

Beyond nuances in meaning, there are some obvious correspondences between Barker's and Bronfenbrenner's conception: Both of them are no process theories in a narrow sense. Barker's "behaviour setting" may be considered as a specification and differentiation of Bronfenbrenner's "microsystem" extended by the behaviour setting "genotype" which refers to common properties of a class of behaviour settings. Barker's "multiple setting" is similar to Bronfenbrenner's "mesosystem". However, the socio-cultural context ("macrosystem") as well as Bronfenbrenner's historical perspective (applicable to the genesis of behaviour settings) remains neglected. Barker's "stream of behaviour" corresponds to Bronfenbrenner's "ongoing behaviour". Bronfenbrenner's concept of "role" as a set of social behaviour expectations may be considered as a specific aspect of Barker's behaviour setting "program". Thus, both approaches prove to be compatible and complementary with regard to their particular aspects.

Brunswik's probabilistic functionalism (Hammond & Bateman, in this issue). Compared to the conceptions of Bronfenbrenner and Barker, Brunswik's "probabilistic functionalism" is another step narrower in scope: The emphasis lies mainly on the problem of perception organisation, thus primarily providing a process theory of perception but not a more general theory of human behaviour. In dissent from Lewin, the focus is on the objective environmental properties. The basic assumptions are: (a) Environment is ambiguous (uncertain) in nature. (b) The (distal) environmental objects are not perceivable *per se* but mediated by a set of (proximal) cues which are considered to be in a probabilistic relation to these objects. (c) Then, what

the organism has to manage with regard to adaptive goals, is to infer reliable judgments by utilising uncertain, probabilistic evidence about the world. (d) In particular, this requires evaluating the functional validity of the cues and the ecological validity of the resulting judgments on an experiential basis in a process of probability learning. Incidentally, the terms „proximal" and „distal", as used by Brunswik and Bronfenbrenner, are quite different in meaning: Brunswik refers to the relation of the organism to cues (proximal) and objects indicated by these cues (distal), while Bronfenbrenner has in mind the individual's relation to the microsystem (proximal) and the more general environmental contexts (distal).

Applying the metaphor of a convex lens which bundles the various incoming cues to the resulting judgment, these assumptions were condensed in Brunswik's "lens model" (e.g., Brunswik, 1955), a conceptual idea borrowed from Fritz Heider (e.g., Heider, 1930). (Taking an applied sport-specific perspective, Hammond & Bateman, in this issue, did not explicitly allude to this concept.) This conception proved to be of high influence on the probabilistic learning theory, decision making, social judgment theory, interpersonal perception of emotions, etc. Furthermore, some basic ideas of fuzzy logic and modern connectionism's concepts of neuronal network structures in cognitive science are anticipated. Despite the very stimulating impact on psychological research from an ecological perspective (see also the concept of "representative design" emphasised by Hammond & Bateman, in this issue), processes within the organism as well as the implications of the fact that the objective environment is to a large extent *created* by mankind and by the individual itself, appear to be largely disregarded.

Affordances in Gibsonian tradition (Fajen, Riley & Turvey, in this issue). Similar to Brunswik's conception, Gibson's "ecological approach to visual perception" (Gibson, 1979; cf. Fajen et al, in this issue) started from the problem of functional perception organisation, based on his groundbreaking studies on pilot training during World War II (in particular, landing airplanes according to the optical ground surface). Both conceptions refer to the objective environment, sharing the assumption – to a certain degree – that environmental objects (source of stimulation) are indicated by explicit higher order structures within the perceptual field containing relevant information about these objects for the perceiver. However, there is at least one remarkable difference between these conceptions: While Brunswik emphasises the probabilistic nature (uncertainty) of the environment, Gibson and his associates hold the more radical position that the "properties of the world are unambiguously specified" (Fajen et al, in this issue). This can be considered as the core of Gibson's concept of "direct perception".

The assumption of direct perception is based on two essentials with regard to the phenomenon and its explanation: (a) As known from every-day observation, the perception-action coupling often appears to operate so fast that it does not allow for any time-consuming mediation processes. (b) If it is true that the properties of the world are unambiguously specified in the pattern of ambient energy arrays, then "perception does not have to involve processes of interpreting ambiguous cues about the properties of the world" (Fajen et al, in this issue). Thus, "actors can achieve direct epistemic contact with their environments", "unmediated" by cognitive inference processes or internal representations (Fajen et al, in this issue). As a consequence, both the classic sensualistic understanding of perception and the representational view in cognitive theories are strictly rejected; furthermore, it opposes representational concepts in motor control research (e.g., Schmidt, 1988). This position appears to be very close to the gestalt theoretical statements by Köhler on "The Characteristics of Organized Entities" and "Behavior" (Köhler, 1947, chap. 6, 7).

According to Fajen et al. (2009), perception and action are "tightly coupled" by "affordances". They are defined "as dispositional properties of the environment that are complemented by dispositional properties of animals termed effectivities". Implicitly applying a key-and-keyhole metaphor, affordances are considered to be "specified in patterns of stimulus energy" which are "inherently meaningful" in the sense of "opportunities for action": "they describe what an animal can or cannot do in a given environment" (Fajen et al, 2009). For example, a step may look "climb-able", a gap "pass-through-able", a ball "kick-able". Thus, the focus lies on the potential relation between environmental properties and the person's capabilities[2]. This is in contrast to Lewin's preceding concept of environmental "valence" which emphasises the perceived motivational qualities of the environment, inviting the person to perform an action to satisfy "quasi-needs" (e.g., Lewin, 1926; see also Koffka, 1935).

The affordance concept shows remarkable correspondences to some aspects of the ecological approaches discussed above. In particular, Barker's "synomorphy"-relation between behaviour and milieu (cf. Kaminisky, in this issue), the "intuitive" character of this relation assumed by Hammond and Bateman (2009) and Barker's behaviour setting "program" seem to be ideas on the same line. Although Gibsonians would probably reject this 'representational' interpretation, "social affordances" described by Fajen et al. (in

[2] See also the understanding of objects as "frozen actions" proposed by Rombach (1987).

this issue), in particular "perceived affordances for joint action", may be considered as functional related to Bronfenbrenner's role expectations (cf. Krebs, in this issue): Joint action implies the expectation that the other person will perceive, accept and play the complementary role. "Perceptual attunement" and "(re-)calibration" on the basis of learning and practice (Fajen et al., in this issue) appear to be – in the core of the matter – implicitly (although not in theoretical notion) very close to Brunswik's concept of cue utilisation: In both cases, the novice should learn to "rely" on the "informational variables or cues" that "specify the relevant properties" (Fajen et al.). If this notion makes any sense, then it implies (a) distinguishing between relevant and irrelevant information, and (b) referring to the functional and ecological validity of these variables (Brunswik). Hence, the Gibsonian idea of "detecting" specifying information seems functionally equivalent to Brunswik's idea of changing the weights of the available information variables appropriately.

Concerning *learning* in general, the following problems arise: Neither Gibson (1979) nor Fajen el al. (in this issue) provided an elaborated *process* theory of learning with regard to the underlying learning mechanisms (more or less they refer to the *result* of learning in the sense of "better than before"). Concepts like "attunement" and "calibration" emphasise specific tasks and effects of learning; they tell nothing about *how* attunement and calibration are achieved (except "by practice"). Notions like "learning to detect" or "to rely on" the right information are descriptive at the best; they are no explanatory terms: When a person learns to perceive something which he or she did not perceive before, *why* and *how* does this happen? What *processes* within the person result in this change? Furthermore, the set of assumptions by Fajen et al. (in this issues) is not stringently conclusive: If environmental properties are "unambiguously" specified and perception is "direct", and if perception and action are "tightly" coupled, then novices *cannot* perceive ("rely on") "non-specifying variables or cues" and perform an inappropriate action (except the – explicitly excluded – case of misperception) – or what they perceive and do is not considered as "perception" and "action". If novices have to *learn* to "rely" on "specifying variables", then the ambient array *cannot* be "unambiguously" specified for the actor in the sense of direct *perception* – or *direct* perception is not a general principle that, e.g., "capture information-movement relations in perceptual-motor skill", but a more or less approximated *ideal*, at the best an end-product of preceding processes. However, if some kind of misperception does occur (relying on non-relevant information variables, that is, variables with low ecological validity), then learning to "rely" on specifying variables means to alter the weights of the

perceivable "information variables" (including 0- an 1-values);. this is what Brunswik tells us.

In summary, the affordance concept, particularly in the extended version proposed by Fajen et al. (in this issue), provides very stimulating insight into fundamental aspects of perception-based human actions. However, it should not be mistaken as a comprehensive conception either with respect to perception and action or with regard to the perception-action relation. This needs some further comment.

In the tradition of Gibson, the environment is designed as a structured perceptual field which is investigated with regard to its potential relevance to the *immediate* shaping of corresponding behaviours by "simply picking up the relevant information" (Fajen et al., in this issue). However, as Ullman (1980, p. 375) conclusively pointed out, rejecting the combination of sensations assumed by the classic sensory-based theory of perception does not justify by itself the conclusion that other alternatives to "direct perception" are also refuted, and mediation processes such as categorization, interpretation, inference, etc. have no place in the theory of perception. Furthermore, it is "nothing but a tautology", if only "stimuli that give rise unambiguously to unique perceptions are considered" (e.g., excluding the conditions of misperceptions and illusions), "then stimuli and percepts are related by a one-to-one mapping" (Ullman, 1980, p. 379). Moreover, the focus is on the what- and how-question of spontaneous perception while neglecting the why- or wherefore-question of intentional observation. The latter would involve applying heuristic strategies which actively guide goal-directed perceptual searching, selection and restructuring procedures based on internal representations. Aside from perceptual conditions of behaviour organisation, other important aspects of perception remain unnoticed: particularly the perceptual basis of intention formation and of developing realistic representations of the actual properties of one-self ('self-concept') and environment ('world view'), which in turn are of perceptual and behavioural relevance. The time perspective is restricted to the present situation, thus the possible priming effects on perception resulting from past experiences and future expectations are not taken sufficiently into account. In general, there is no explicit notion on different basic functions of perception in action which would provide a systematic distinction of functional properties of affordances with regard to orientation, selection, initialisation and control of an action.

Concerning the notion on perception without mediating cognitive processes, a fundamental problem has to be solved: If the existence of cognitive processes is not principally denied, and if cognitive processes have an evolution-based adaptive function in the interaction of person and environment,

and the person acts as a system as a whole, then it is highly questionable maintaining the *general* assumption in spite of these facts that "the environment can be perceived without the process requiring cognitive mediation" (Fajen et al., in this issue). If perception operates without internal representation, how then should it be possible to identify objects in the perceptual field which are partly covert or blurred?[3] (We should also keep in mind that perceptual ambiguity is the basis of projective testing in psycho-diagnostics.)

My impression is that Fajen et al. (in this issue) let in through the back door what was kicked out through the front door. Several statements refer explicitly to the inner perspective of the acting person and its knowledge, for example: "In American football, a quarterback must know [!] how high a receiver can jump to reach a pass …." The terms "social" and "sport" are extensively used within the frame of reference of direct perception and affordance in spite of the fact that there is no way to directly extract the social or sportive character of something out of the ambient energy array *per se* without additional internal representations. Even experiments on catching or hitting a ball can only be conducted, when we assume that the subjects cognitively represent and intent the task they are asked to fulfill.

Although the term "action" is used, its meaning is reduced to the performance of relatively simple and isolated perceptual-motor skills, emphasising the 'ability aspect' without any explicit reference to intention, motivation, emotion, or cognitive anticipation, planning and evaluation. Fajen et al. (in this issue) are right in paying special attention to learning processes concerning novice-expert differences, "perceptual attunement" and "(re-)calibration". However, they made no point on their understanding of learning, thus avoiding to have to deal with a critical problem: learning without developing corresponding internal representations. In my opinion, the essential point is not to reject or endorse the role of cognitions and internal representations, but to specify the conditions under which they are or are not necessary and useful (see also Ullman, 1980, p. 375).

This leads to an essential requirement concerning theory construction, namely to pay careful attention to the epistemological status of the if-then relations in our explanations with regard to the kind and directness of the relation between conditions and consequences. It makes a great difference to consider the "direct" relation between stimulus information and perception as well as the "tight coupling between perception and action" (Fajen et al., in

[3] Gibson's (1979) explanation of perception under the condition of partly occluded surfaces provides some basic insight into this phenomenon. However, it does not refer to the fact that we can perceive and identify, for example, a *certain* person that is partly visible.

this issue) as (a) a phenomenological relation in the sense of being not aware of the underlying processes; (b) an implication of a molar theoretical perspective excluding the underlying 'micro'-processes as non-psychological, or (c) a causal relation in the sense of unmediated determination.

Especially, there are two aspects that seem to be relevant for a differentiated understanding of the perception-action relation. First should be taken into account the following distinction: (a) *condition of possibility* (see Gibson's affordances; "real affordances" according to Norman, 1999), e.g., a ground may be 'walk-on-able'; (b) *condition of occurrence* in the sense of Norman's "perceived affordances"; e.g., a ground surface may afford 'walking'; (c) *condition of appearance* according to Lewin's environmental valences, e.g., 'walk!'. Neglecting these distinctions would lead to an inconsistent use of the term "affordance" and result in terminological confusion. Second, we have to distinguish between *necessary* and *sufficient conditions*. If, and only if, the environmental properties determine completely some behaviour, they are necessary and sufficient conditions of that behaviour, thus allowing its prediction. This is not valid for affordances as opportunities for action in the sense of Gibson. In some cases however, the visual properties of environment may be sufficient conditions of perception and behaviour as well (e.g., optical delusions), but not always necessary (e.g., moving with closed eyes), or reference to the ambient energy array may be a necessary but no sufficient condition of behaviour (e.g., traffic signs). The latter give reasons for further important differentiations.

Starting from the generally accepted fact that behaviour is related to the meaning of environmental objects, the perception-behaviour coupling can be established at least on three different levels:

(1) *animal-specific* on the basis of biological evolution (cf. Holzkamp, 1973, p. 320 f.; Mausfeld, 2001, p. 441): Perception and action are *a priori* interrelated in the sense of a 'natural correspondence'. This seems to be the primary focus of Gibson's original affordance concept.

(2) *individual-specific* in the sense of 'personal correspondence'*:* The perception-behaviour relation depends on (a) the individual's properties according to ontogenetic development and/or (b) experiences made by the individual him- or herself or acquired in observational learning processes. Particularly the first point is in the focus of Fajen et al. (in this issue) with regard to the relation of "affordances" and "effectivities", additionally including actual states like "fatigue".

(3) *culture-specific* in the sense of a 'conventional correspondence' (cf. Norman, 1999): The meaning of perceptual structures is – beyond the characteristics of the perceptual surface – based on social conventions adopted in

the process of socialisation, e.g., flags, tricots, traffic signals, bank-notes, letters in writings, play grounds in sport, gestures of referees, handling of sports kits, perception of persons as team members or opponents, etc. Even a chair may be more than a 'sit-on-able' object, namely a social status symbol. In basketball the basket offers itself to have the ball thrown into it, but hopefully into the basket of the opponent team. Outside the laboratory, we do not live in a world of 'walk-on-able', 'step-on-able', 'grasp-able', "catch-able' or 'hit-able' things. Beyond that, we live in a world of social symbols and conventions. Last but not least, it is not a world of objects only, but a world of conceptual denominated objects, which needs explicit reference to language while investigating the person-environment relation. At the best, Fajen et al. (2009) refer only implicitly and partially to this aspect.

Now, the essential point is that on all of the three levels the *phenomenon* of "direct perception" can be observed, i.e., the meaning of environmental properties can be perceived without time-consuming mediation processes. However, perception of affordances may prove to be only *one* of possible *explanations* of this fact (or a valid explanation of a special case): The perceptual field provides by itself the informational basis of behaviour, and the transformation of perception into behaviour is so fast, because mediating cognitive processes are *principally* excluded. A possible alternative explanation would start from the distinction between perceptual learning and actual perception on the one hand, and motor learning and motor control on the other: What happens during the learning process is quite different to what happens during the application process: During the learning process, the perception-behaviour relation is cognitively (pre-)structured (high degree of awareness and explicit cognitive control of action at the beginner level; development of internal representations) and stabilised by practice (automatic processing at the expert level). Then, the actual perception-behaviour coupling at the expert level can operate so fast because of preceding *automatisation* which makes time-consuming cognitive mediation processes *in situ* more or less unnecessary. Furthermore, it may also be worth paying additional attention to a specified *representational* view on the issue of "tight coupling between perception and action", which is quite different from the position held by Fajen et al. (in this issue), namely the principle of "common coding of perception and action" within a recent representational framework (see Hommel, Müsseler, Aschersleben & Prinz, 2001; Prinz, 1990)[4].

[4] The basic assumption of this approach is that representations of stimulus information ("event code") and action ("action code") are directly interrelated within a common representational system.

Applications to the Field of Sport

General Aspects

All authors of the conceptions under discussion argue that the conception they relate to is of high theoretical, methodological and practical relevance to the field of sport. I agree with them. However, we should be aware of the fact that these conceptions do not cover the whole range of sport activities. They are – at least in the presented versions – primarily related to skill-based motor behaviour of athletes, thus making no point either to other persons involved in sport (e.g., referees, spectators) or to other intentions of sport activity than competition (e.g., health sport, adventure sport), or applying sport as a means of psychological intervention. Tactical aspects of sport behaviour are also widely neglected (except by Hammond & Bateman: their "match lesson" of tennis implies some tactical elements).

Because the components of these conceptions are already thought to be transferred to sport, well-illustrated with respect to sport and commented above, it is not necessary to go back to them once more. Thus, it may be sufficient to add a few comments and ideas on practical aspects which go beyond the common message: "Be aware of the properties of the objective environmental context while intending to improve the behaviour which takes place within this context."

Specifications

Krebs (in this issue) demonstrated the applicability of Bronfenbrenner's ecological model to the development of sports talents. Although several propositions seem to be very close to what we already know from literature on motor learning and training in sport as well as on career counselling (cf. Hackfort & Schlattmann, 1994), the systematic ecological approach, including a great variety of variables, remains impressing. The proposed "stage model" intends to stimulate sport participation, enlarge and tighten the environmental network, and increase task complexity and the athlete's specialisation by a step-by-step procedure. Of special interest are the statements on optimal conditions for transitions from one context to another (e.g., moving to another team), and on "developmentally-disruptive" and "developmentally generative" dispositions of athletes. Beyond this, it is recommendable to pay more attention to the 'harmonious' interconnection of different environmental systems on the meso- and exosystem level, the impact of cultural and

social ideologies (macrosystem), and the athletes' future perspective after finishing their sport career.

Kaminski (in this issue) illustrated the usefulness of the Barkerian approach particularly by analysing the behaviour settings of beginner skiers, table tennis and soccer. Remarkably, he extended Barker's original approach by involving the inner perspective of the athlete, i.e., theoretically with explicit reference to cognitions and emotions, opting for "'*action'* as a general conceptual frame", as well as methodologically (questioning methods). Additionally, the behaviour setting perspective may be stimulating with regard to the following aspects: (a) development of taxonomy of sport-specific behaviour setting "genotypes"; (b) analysis of behavioural implications of inconsistent, ambiguous, conflicting or even paradoxical behaviour setting "programs" (see, for example, violence and doping in sport); (c) treatment of adaptive problems and decreasing achievement of athletes and coaches resulting from an imperfect person-setting fit (e.g., integration of foreign players into a new team).

Hammond and Bateman (2009) exemplarily illustrated Brunswik's concepts of "probabilistic functionalism" and "representative design" with regard to tennis. They showed that different locations of the player on the court produce different kinds of stress, thus demanding different kinds of training. Favouring the "outer game" versus the "inner game" perspective, they developed a training procedure ("match lesson") according to the empirical probability of success of shots from different court regions. This is a very fruitful application of Brunswik's ideas. To further improve the proposed match training, specifying its conditions may be recommendable with regard to (a) the reference group according to gender, age, constitution and skill level of the player; (b) the actual situation of the match (e.g., stage of the game; own service); (c) the individual 'style' of playing the game (e.g., offensive-oriented); (d) the actual state of the player (e.g., fatigue); (e) the detection of relevant cues for optimal tactical decisions (see Brunswik's "lens model"). Above all, the probably most interesting question is: How the player's effectiveness might be enhanced by creating new variants of behaviour derived from the Brunswik model?

The conception of Fajen et al. (in this issue) in tradition of the Gibsonian approach was already discussed at length. Only few points should be added. Fajen et al. focused on the visual control of "interceptive actions" in sport which they consider as a typical case of affordance-based direct perception related to the athletes' "effectivities". The essential practical message which can be drawn from this conception is learning to 'read' the objective environmental properties. It has to be added that learning to *ignore* (not to rely on) perceived affordances and/or block the corresponding behaviour is

equally important, if the perceived affordance provides an opportunity for action with harmful secondary consequences (so-called 'action traps', e.g., feinting movements of an opponent in sport; water or ground surfaces hiding high risks for the actor). Finally, there is no distinction made between 'what is possible to do' and 'what is important to do'. Completely neglected is what may be called 'emotional affordances' (cf. Norman, 2004).

The Action-Theoretical Frame of Reference

General Aspects

Action theory in our understanding is not a 'closed' theory but conceptualised as a meta-theoretical *perspective* in continuous progress. Several of the comments above on ecological approaches are already implicitly made from this perspective.

The action-theoretical paradigm is characterised by three fundamental assumptions: (1) The basic nature of human behaviour is expressed by the *intentional organisation* of behaviour within a meaningful situational context, i.e., action. (2) Psychological states and processes are considered and explained with regard to their *functional relation to action*. (3) Constitutive for any action is the *functional integration* of (a) person and environment; (b) intrapersonal processes; (c) time perspective with regard to the past, present and future. Accordingly, action theory is a systems approach highlighting 'action' as the key concept in psychological theory building and frame of reference for research and intervention. The implications of this perspective, which was developed at the Psychological Institute of the German Sport University Cologne throughout more than 30 years, cannot be outlined here at full length (see for detailed information Nitsch, 2004). Instead, the focus will be – briefly summarised – on selected aspects which may lead to a more differentiated understanding of the peculiarities, strengths and shortcomings of the ecological approaches under discussion.

The Structure of Action Situations

Time perspective. Present situations and actions depend on preceding situations and actions based on (a) direct influences and (b) indirect influences mediated by subjective interpretations of the past (see Figure 2). The organisation of present actions additionally involves anticipating future situational changes and structural and functional demands of the subsequent

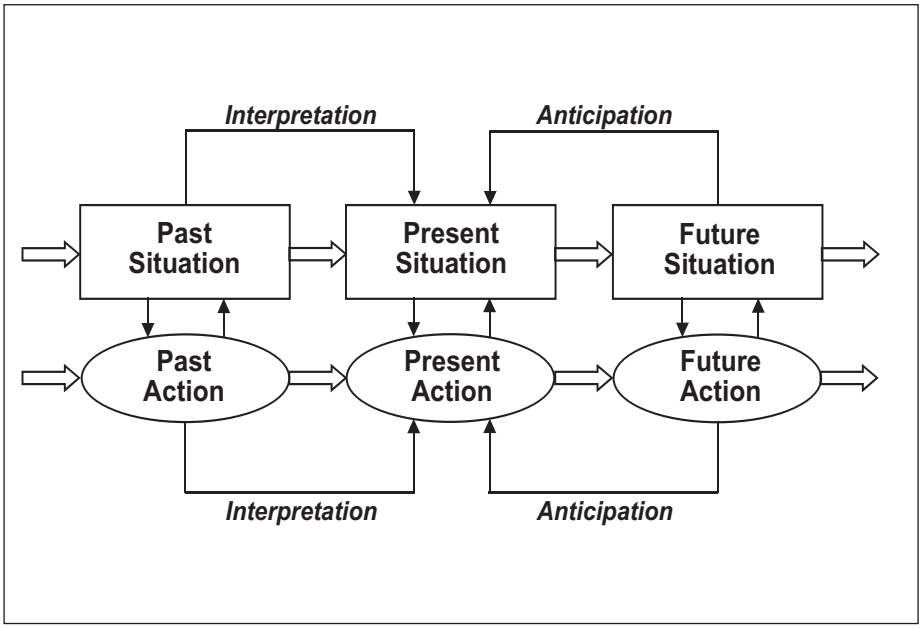

Fig. 2. Action-related time perspectives.

action (e.g., throwing a handball is already anticipated while catching that ball). To prevent possible misunderstanding: The term 'situation' is not used synonym to 'environment', but refers to the person-environment *relation* as specified later including a third component.

More generally, investigations of human behaviour within its environmental context can only be appropriate and complete, when they take into account both situation-action history and future perspective. The ecological conceptions commented above referred quite differently to this aspect: explicitly by Krebs ("chronosystems") (2009) and Kaminski (2009) ("stream of action"), however more or less emphasising the past; Fajen et al. within a very narrow scope only ("prospective control of action"); no statement on this issue by Hammond and Bateman.

Situation components. Within the ecological conceptions discussed above, behaviour has been considered as a function of person and environment. However, we are continuously confronted with the problem of structuring the person-environment relation by ourselves, i.e., *actively and intentionally* solving adaptation tasks. In this sense, *action* means dealing with the environment in the perspective of a particular task. Thus, the situational con-

text of action is constituted by the functional interrelation of *three* components: person, environment and task (Nitsch & Hackfort, 1981, p. 278; see Figure 3). Optimising this interrelation is the general objective of action and the general intention of practical interventions. The ecological conceptions discussed above partly refer to task properties, but not in the sense of a *constitutive* component of the behavioural context equally ranked to person and environment.

Concerning the fundamental problem of biological adaptation, the interrelation of person, environment and task needs further differentiation (see Figure 3): The configuration of those properties of the situation components which determines the *urgency* of adaptation is called *valence relation*. The configuration of those properties which determine the *difficulty* of adaptation is called *competence relation*. Thus, the actual situation specifies what should or should not and can or cannot be done, how, when and where. Both the properties of person, environment and task themselves as well as the twofold interrelation between them can be considered from an outside (objective) or an inside (subjective) perspective. This leads to a further central aspect of action theory.

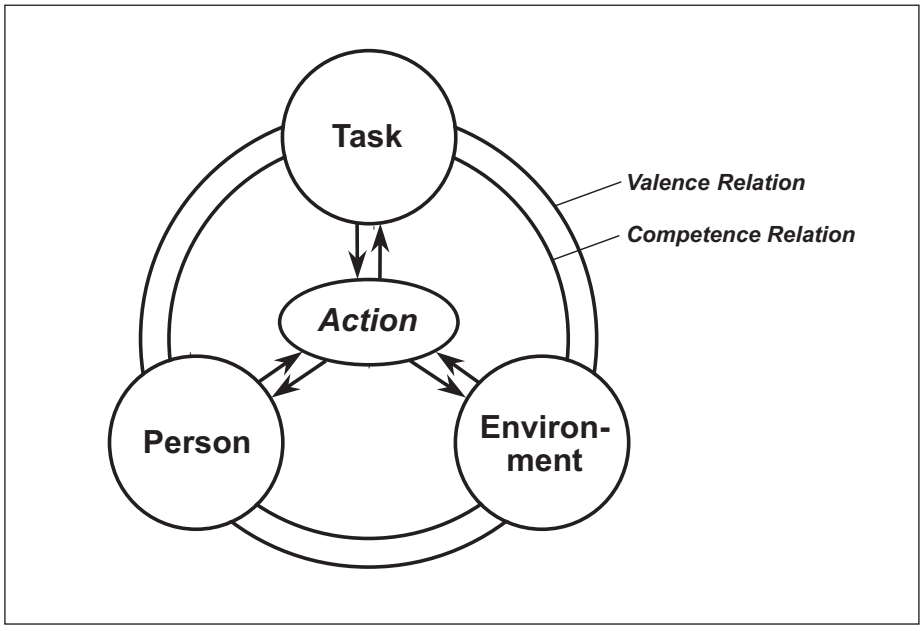

Fig. 3. The situational context of action.

Subjective situation definition. The *perceived* configuration of person, environment and task – resulting in the subjective definition of one's own situation – is considered as the essential basis of *intentional* behaviour, i.e., action (Figure 4). Consensual situation definitions are essential for social communication and interaction. Problems would occur, for example, when the view of an athlete dissent from the view of his or her coach.

Each of the situation components is subjectively appraised with respect to the two situation dimensions mentioned above: (1) *valence* related to the subjective attractiveness or repulsiveness of the situation; (2) *competence* related to the subjective controllability of the situation (see Figure 4). Then, deciding on acting or not acting depends on the perceived degree of valence and competence, and the valence-competence relation.

Within a system concept of situational dynamics, there are two situation variations of principle interest: (a) A subjective change in one of the situation components leads to an altered perception of the other ones: For example, the perception of one's capabilities will change depending on the given task; altered personal properties (e.g., due to increasing fatigue, learning, falling ill or growing older) will result in a change in the perception of given tasks and

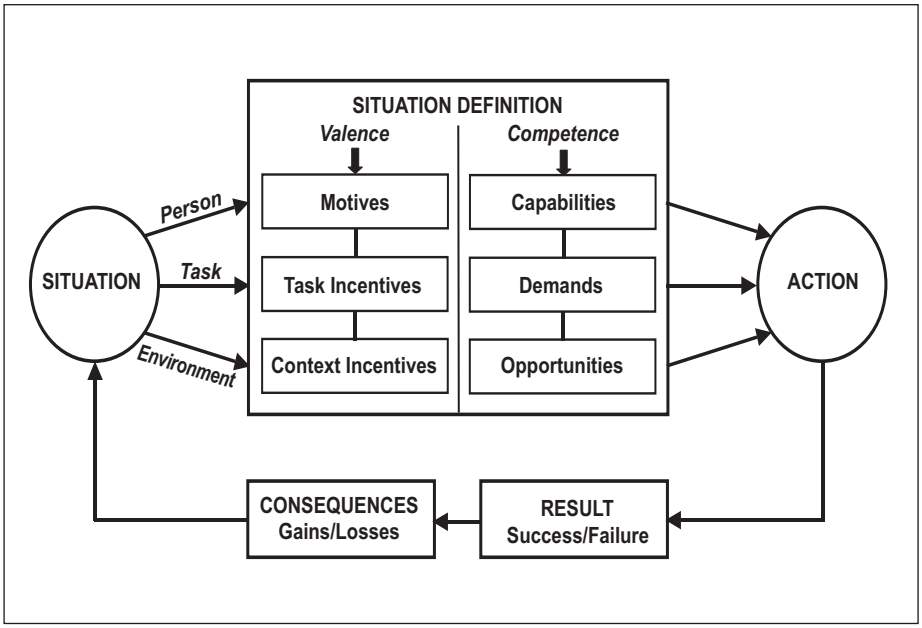

Fig. 4. Structure of subjective situation definitions: Appraisal dimensions related to situation components.

environmental conditions. (b) The characteristics of the situation components and their interrelations are permanently changing throughout the course of an action.

Taking an outside perspective, subjective situation definition is completely outside the scope of the ecological conceptions of Barker (see Kaminski, 2009), Hammond & Bateman (2009), Fajen et al. (2009). Krebs (related to Bronfenbrenner) and Kaminski (expanding the Barkerian conception) explicitly refer to subjective experiences, however without further elaborating this aspect in the sense of a systematically structured theoretical construct. Furthermore, focusing on the (objectively defined) competence aspect only is, in particular, a characteristic ingredient of the conception of Fajen et al. (2009).

The Functional Architecture of Actions

Dispositional levels of person-environment interaction. The organisation of action involves the interplay of different levels (see Figure 5) which are characterised as follows: (a) At each level, different dispositional properties of the person specify his or her potential capabilities for action[5], i.e., *physical* ones (in the sense of anthropometric properties, e.g., body height, leg length, weight, volume etc.), *biological* ones (referred to the neuro-physiological, endocrine and metabolic functioning of the organism), *mental* ones (e.g., intentions, cognitions, feelings; mental skills) and *social* ones (internalised social values and role expectations; social skills). (b) The personal disposition systems are considered as functional interdependent. For example, anthropometric properties (physical disposition system) have potential impact on energy expenditure during action (biological disposition system); internalized social values and expectations (social disposition system) potentially constrain the individual's decision making and intention formation (mental disposition system).[6] (c) Different personal disposition systems specify different relations to the environmental context. (d) Each level of action organisation is governed by specific rules of functioning.

Without going into details here, the essential point is: Each of these levels – physical, biological, mental and social – establishes specific sets of

[5] As (real) dispositions, they are merely *potential* until they are (selectively!) *actualised* by changes within person and/or environment which make active behaviour or its adaptation to the altered conditions necessary.

[6] In an extended sense, these personal dispositions may be considered as differentiating the concept of „effectivities" by Fajen et al. (2009).

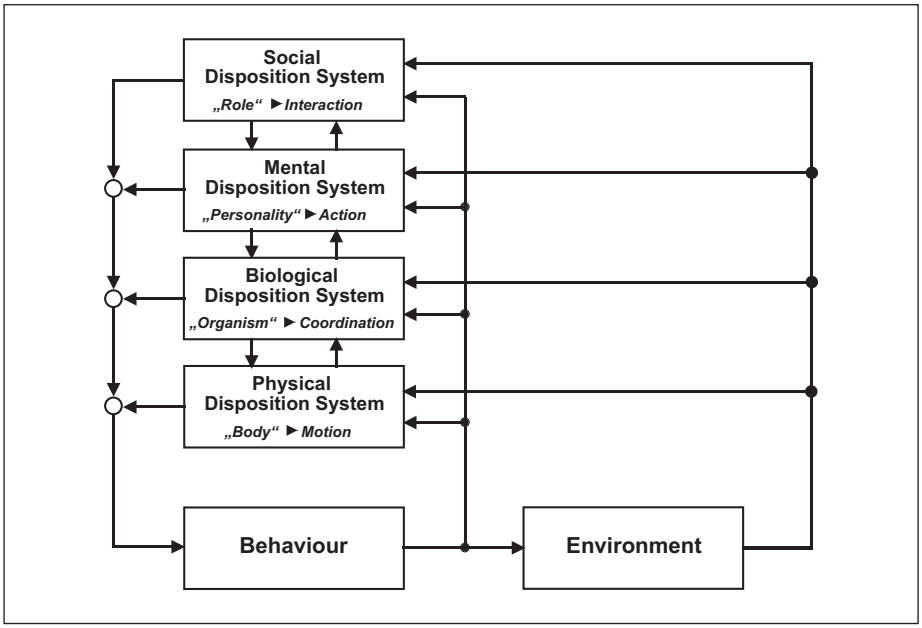

Fig. 5. Person-environment interrelations according to different system levels of personal dispositions.

objective constraints and subjective options of action (see also the distinction between "real" and "perceived affordances" by Norman, 1999). Now, it becomes clearer what was already mentioned above: The discussed ecological concepts refer very differently and selectively to these levels of action organisation, ranging from anthropometric properties ("body-scaled affordances", Fajen et al., in this issue) to social conventions related to Bronfenbrenner's "macrosystem"(Krebs, in this issue).

Phase structure of actions. Action involves more than overt behaviour. The notion of "person as an active agent" in ecological theories should not be reduced to the objective person-environment relation. It has also to be applied to the processes within the acting person. A first account to this point is differentiating the functional time structure of action from a psychological point of view. This leads to the triadic phase model of action (see Figure 6). If we want to sufficiently understand what happens in the person-environment interrelation, then we have to take into account what happens in each of the three phases: anticipation, realisation and interpretation. None of the discussed ecological conceptions systematically outlines the time structure of actions in the sense of a sequence of functionally specified phases.

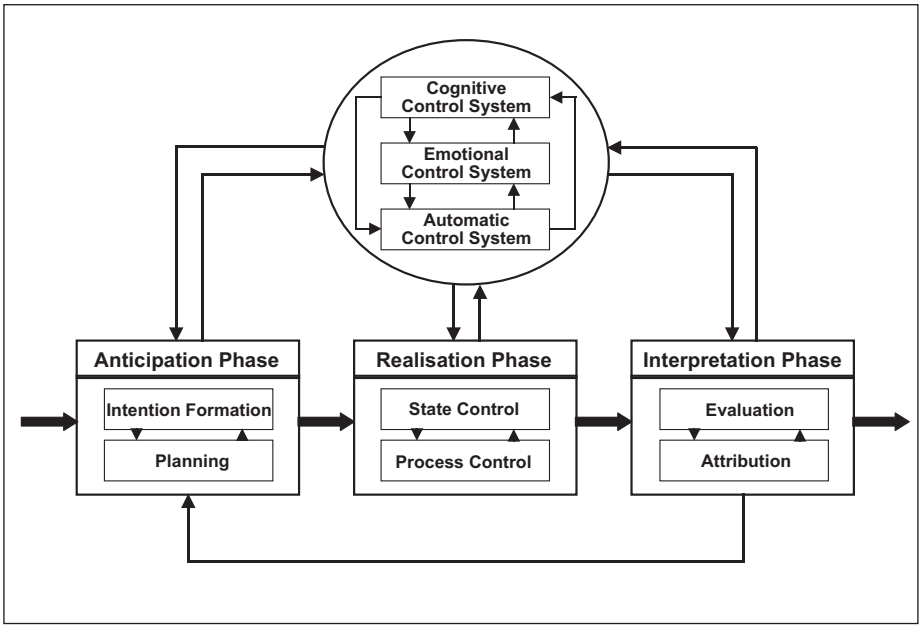

Fig. 6. Action phases and action control systems.

Action control systems. The second account to the 'active agent' notion is stimulated by evolution theory, particularly with respect to the differentiation of behaviour control mechanisms throughout the development of mankind. Adopting this perspective, human action control is considered to operate in three different but functionally interrelated ways (see Figure 6). Each of these control systems – cognitive, emotional and automatic – is specialised with regard to particular functions in the overall control of the action, and may become dominant in the case of voluntary, emotional or habitual action. In dissent from other emotion concepts, emotion is understood as a basic function in the orientation, activation and regulation of actions. Understanding action as controlled by *three* functionally specialised systems may open a more differentiated perspective on the person-behaviour-environment relation than the discussed ecological conceptions offered or applied.

Conclusion

The general credo of sport psychological intervention is helping persons or groups to do the right thing, in the right way, on the right place, at the right

time. Attaining this goal in a systematic, efficient and responsible way requires a sound theoretical basis. Undoubtedly, the ecological approaches commented above provide very fruitful contributions to an extended theoretical understanding of sport activity, its further investigation and practical improvement.

Environmental properties are described in physical, behavioural and/or sociological terms. It should be a challenge for future conceptions to systematically apply *psychological* terms in a specific sense: A promising starting point may be differentiating *basic intentional orientations* in the person-environment interrelation. This would lead to characterise environmental contexts according to their relevance to these orientations, e.g., gaining and maintaining the individual's *safeness*, *competence*, *experience* and *identity* from a physical, mental and social perspective.

Furthermore, the functional role of language in motor learning and motor control as well as its mediating function in the person-environment interaction deserve particular attention.

Of course, taking into account all of the multifarious aspects within a single investigation would lead to unmanageable complexity. However, it is necessary to make reductions in a systematic manner keeping in mind that the focus is on a more or less small part of the whole picture, and this part has to be compatible with the context it refers to. In this sense, the action-theoretical frame of reference may be considered as 'cognitive map' which helps to structure theory building, research and intervention.

The common message of the ecological conceptions is: "Be aware of the properties of the objective environmental context while intending to improve the behaviour which takes place within this context." However, this message needs an essential supplement: "Don't forget the person who intentionally acts within this context."

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