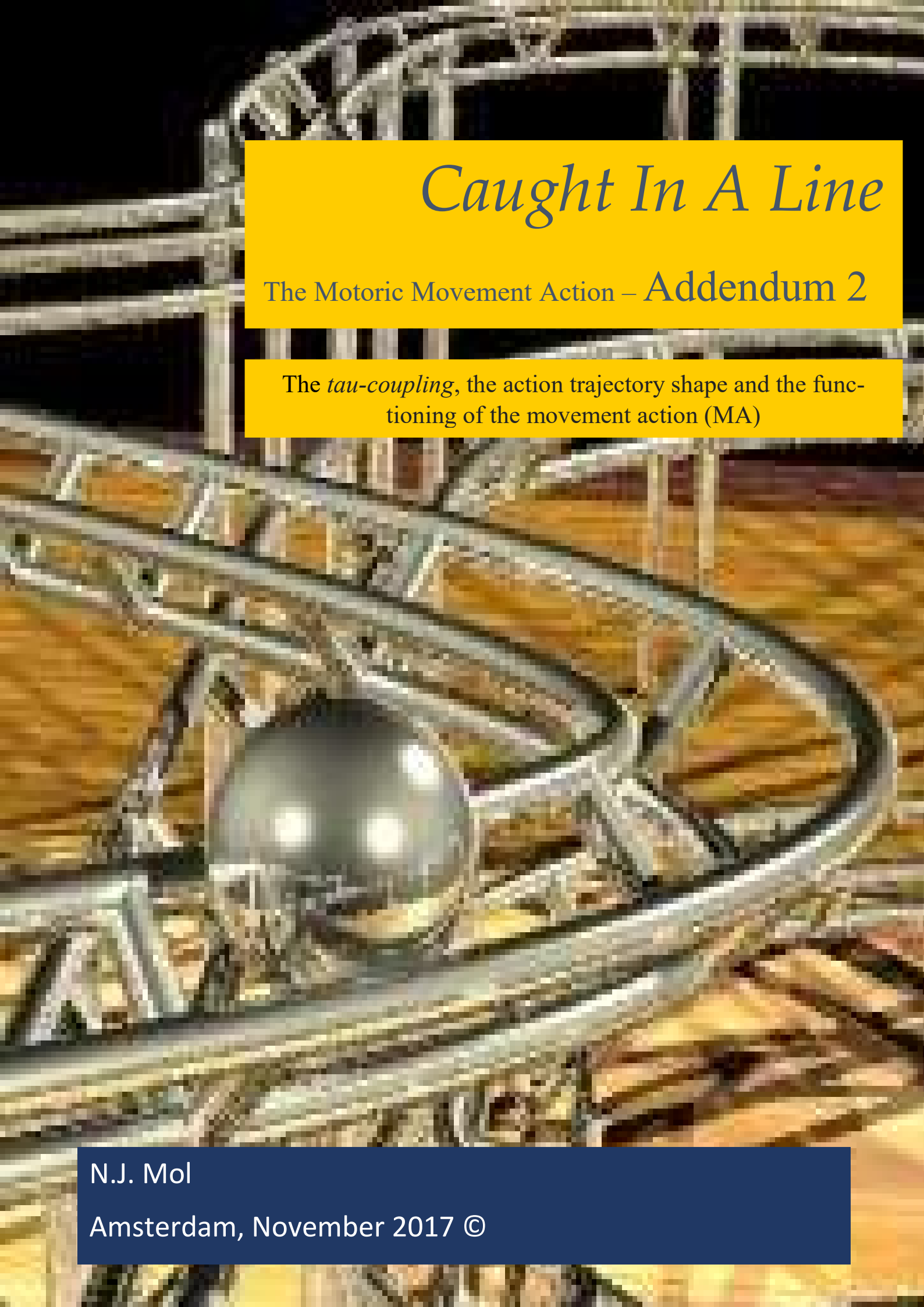

Caught In A Line

The Motoric Movement Action – Addendum 2

The *tau-coupling*, the action trajectory shape and the functioning of the movement action (MA)

N.J. Mol

Amsterdam, November 2017 ©

Caught In A Line

The Motoric Movement Action
The explanatory model of all motoric movements
Addendum 2

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Caught In A Line – The explanatory model of all motoric movement actions

Addendum 2 – The *tau-coupling*, the action trajectory shape and the functioning of the movement action (MA)

Contents

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"What is so fascinating about a marble run?[1] *You release the marble at the top and you know that a spherical object will roll down due to gravity. Is it because we let something move what can't move by itself? Is it because something is still moving while our effort stopped a long time ago? Or is it the fact that we impose our will to the marble to follow a defined path? Whatever the answer might be it will remain fascinating to stand in a mountain stream in summer and influence the water stream by just changing a few rocks. We are not able to control matter but we are able to control the direction of the matter."*[2]

Image: A classic set marble run. Before you release the marble at the top you know exactly which shape the marble will have to follow[3]. Within a set classic marble run one can only see the actual place of the marble within a further invisible action trajectory[4]. However within the Motoric Movement Action *writing*, *pouring* and *nerve spiral*[5] the whole action trajectory shape will conversely become visible.

0. <u>The marble run</u>[6]

A classic marble run has one *whole* set shape (!). The starting and ending point are just two of the numerous parts of that shape[7]. It defines exactly which shape the marble will have to follow. In

[1] I still remember my childhood being intrigued by the rolling marbles. It was the same feeling I later felt with the tumbling of domino stones. The explanatory model creates a clear link between the Motoric Movement Action *catching* and the Motoric Movement Action *not-catching/fleeing/avoiding*. The movement actions (MA) of both actions are in fact identical. In that way the visual perception in Motoric Movement Actions obtains a more general context and does it provide a clear link to the recently developed insights within *neuron mirror imaging* research. That could probably lead to the conclusion that the fascination within my childhood has a clear physiological origin.

[2] Cover text within the book *Caught In A Line*; http://watchtheballtrajectory.jouwweb.nl/downloads-1.

[3] It is important that you start to see that you create the shape out of the perspective of the marble.

[4] So although the marble doesn't leave any actual footprints of manifest places P of the marble one will be able to visibly perceive the casing/enclosure of the shape very well.

[5] See: Appendices B, C and D of addendum 1.

[6] https://www.youtube.com/watch?v=_vg9J_4-kd8; https://www.youtube.com/watch?v=QQ9gs-5lRKc; https://www.youtube.com/watch?v=BfeHg0Zu1WQ;

[7] See: Appendix A; *The ball trajectory shape.*

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there it is important to notice that the shape also includes the time frame[8] involved and the length of the marble run. Equal marbles will pass the same route in an equal time. Every time frame one is able to make a statement about the actual place of the marble and the manifest and the latent part of the marble trajectory shape. There is a mutual relationship in there.

The marble will create the actual ball trajectory shape but it is also destined to follow the preset shape. If we want to make statements about the state of the marble run process than we need to compare the manifest line with the latent part of that line out of the perspective of the marble. The explanatory model will show that this state of the action trajectory, the closing of a line segment, also provides the leading *tau*-value ($tau^{Gap}{}_{MA}$) for the timing within the movement action (MA). The closing of this gap will lead the *dependent* motoric movement (MM) and by doing so it will lead the timing, the *tau*-value ($tau^{Gap}{}_{MM}$), of the relevant movement trajectories[9]. Together they determine the *functional tau*-coupling[10].
In comparison to most Motoric Movement Actions one is able to assess not only a *precise* image of a *global* ball trajectory shape within a set, classic, marble run before the action starts but even a *precise* image[11] of a *precise* ball trajectory shape[12]. The fluctuation margins of possible deviations within the perceptual perception of future places of the marble will be very limited or nihil[13].

<u>The marble run versus the action trajectory within the Motoric Movement Action</u>

In every Motoric Movement Action we first visualize a perceptual image of a latent marble run over which the movement action (MA) will be executed[14]. This visualisation concerns a complete, a whole line segment shape (!) of a, (invisible) *marble run*. It is visualized out of the perspective of

[8] The time frame in which an action trajectory is created also belongs to the shape of the action trajectory. So the fluctuation borders of these time frames can also be predicted in a *precise global* way.
[9] To better understand the autonomy of the movement action (MA) it is important to realize that we are able to interrupt the marble within the marble run at any place but that we are also able to decide to not interrupt it. For the movement action (MA) that makes no difference at all. See also appendix B; The Motoric Movement Action *catching* versus the Motoric Movement Action *not-catching*.
[10] If at any moment you would decide to grab the rolling marble out of the marble run then you will also have to create a trajectory shape, a movement trajectory within the motoric movement (MM), out of your fingertips to a set interception point determined by the tactical movement action. With the movement of the fingertips over this trajectory shape towards that point you will also create a *tau*-value. Namely the *following tau*-value of the motoric movement ($tau^{G}{}_{MM}$). If you want to intercept the marble just at the moment when the marble appears into the intersection point of these two line shapes then you will have to let this following *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) come to zero when the leading *tau*-value of the movement action ($tau^{G}{}_{MA}$) also approaches zero to that intersection point.
[11] It is essential that you start to see that the shape of a classic marble run allows us to create a *precise* perceptual image of all future places P of the marble in a very early phase but that the *tau*-value can only be determined in a *precise global* way at that very early moment. Although the marble will have hardly any chance to deviate at any random point P when it comes to the *width* of the shape, it will be able to deviate in a *normal* way in *time* in the *length* of the shape.
[12] With the description of the Motoric Movement Actions *bobsleighing/luging etc*., *car racing*, *free diving* the explanatory model will show however that also in very fixed/set marble runs, like for example a bobsleigh run, small deviations will occur. They become manifest in the aforementioned sports because there is hardly any time to correct these deviations because of the high speeds involved.
[13] In the Motoric Movement Action *cat and mouse game* (Appendix E) a *very simple* marble run shape is used. But although it comprises a simple shape the action becomes extremely complex because the marble run is in fact a *non-transparent* tube. That is the crucial reason why this Motoric Movement Action is so hard to execute and the explanation of that complexity shows/*proves* the need for a deliberate cooperation between a perceptual latent image and actual perception processes. To establish a *tau*-value one really needs to experience this relationship (!). It is the relationship that counts. So it appears that the independent phenomena do not possess a lot of (*tau*-)value themselves.
[14] The explanatory model posits that, conform Gibson, the moment we enter a vista/environment a *sea of* (action) *possibilities* are revealed. The explanatory model goes even beyond that statement and says that within every Motoric Movement Action one of those possibilities/*affordances* actually becomes manifest.

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the relevant (movement) action object (i.e. the marble) with the ending point the location where the action object will finally complete the egocentric formulated task. The difference with a real marble run comprises the fact that a perceptual image can only contain a *precise* image of a *global* marble run shape[15].
That has pros and cons. The major advantage is the fact that one is not bound to a set trajectory within an equal Motoric Movement Action and one is allowed to perceptually shape any preferable marble run and adapt it at any given time. This forms a guarantee for maximal creativity and by doing so for 1. a undisturbed progression of the (movement) action object and 2. a successful fulfilment of the egocentric set goal. So because of this one is able to anticipate maximally to unforeseen circumstances and suddenly occurring obstacles[16].
However due to the fact that the *marble*, in comparison to the classic marble run, will then be able to deviate and will deviate from the perceptual image at any place P there needs to be a (extra) control system that will monitor and implement possible deviations at any moment in time. That is the major disadvantage. The explanatory model grants this assignment to the processing processes of the perception, the dorsal and ventral stream. The ventral stream mainly observes the, manifest and latent part of the, marble run but in a set relationship to the actual place of the marble. The dorsal stream mainly observes the actual place of the marble (and by doing so also provides the actual action moments) but in a set relationship to the whole marble run shape. The explanatory model says that both streams have a continuous mutual relationship till the end of a Motoric Movement Action. If the marble deviates from its *action path* than immediately another new *precise global* perceptual image of a latent part of the marble run is created which the marble will then have to follow again[17].

[15] Of course the difference with a physical present marble run is the fact that now you will not be able to perceive *nothing* (!) that looks like a guide rail of the (movement) action object. Now the marble run is invisible and so you have to visualize a physical present marble run each time you are going to execute an action if you want to be convinced of the explanatory model. Later you will be able to see that the *nothing* is an important part of the Motoric Movement Action, that the *nothing* (conform Gibson) contains many invisible marble run trajectory shapes and that the *nothing* contains many advantages.
[16] See for example the assignments belonging to the Motoric Movement Action *grabbing/taking/touching* in the clarification of the action trajectory shape; Chapter 3.b.
[17] In general the marble run is presented as a *precise global* action trajectory shape. Although it must be understood that when the marble run progresses the perceptual image changes from *precise global* to *very precise*. With every point P less within the latent line shape the chance to deviations diminishes exponentially. If our hand really comes close to the apple or an espresso cup then the perceptual image of the still latent part of the action trajectory shape will hardly be able to deviate from what the action trajectory will actually show *later* on. This quick *narrowing down* process is one of the essences of the parsimonious character of the whole complex system. The fact that the perceptual image of the last part of the latent action trajectory will hardly deviate from the actual action trajectory will be able to lead to the practical consequence that within a lot of Motoric Movement Actions one can take away direct vision in an early phase of the action. But that can only occur within these actions in which the fluctuation of the then still occurring deviations within the action trajectory shape can be covered widely within the fluctuation boundaries of the motoric movement (MM). For example the Motoric Movement Actions *thread a needle*, *opening a front door lock* or *(hold-)catching* are not able to fulfil that requirement (because within those actions the motoric movement (MM) needs to align to the movement action (MA) almost 1:1) and so within the end phase of these actions, when the perceptual image of the latent action trajectory shape will already be very precise, there still needs to be direct vision. For more information see for example the actual movement action within the Motoric Movement Action *catching*; Appendix B-2a.

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Introduction

"*If there is a single take-home message from this article it must be that guiding movement purposively is the origin of being. All living creatures from the largest mammal to the tiniest microbe need to do this to live. Therefore to understand what it is to be alive we must understand how movement is guided. We need to grasp this at different levels - anatomical, physiological, neural, molecular, genetic - but first and foremost we need to understand it at the behavioural level. Only then can we ask informed biological questions at lower levels, and so avoid not seeing the wood for the trees.*"[18]

Lee's quote expresses the essence of the position of current scientific research. In short[19] it comes down to the fact that many scientific research is executed at other levels than the behavioural/functional level without knowing what is exactly happening at that functional level. Lee, who conversely wants to answer functional questions with his *tau*-theory, rightfully argues that because of this we are not seeing the wood for the trees. In spite of the fact that a lot of scientific research is executed in the right direction the outcome of the research maintains to keep a feeling of random found phenomena when there is no model, no explanatory model, involved. That is why it is impossible to formulate explicit, ending sequences of, follow-up questions and this can be seen clearly in current scientific research. In the near future one will be able to see in retrospect that it wasn't about if the discovered phenomena were right or wrong but that they remained without a strict *framework* (!). The conclusions drawn from the discovered *right* phenomena are most of the time *wrong* because they miss that, complex system[20], framework and are randomly linked to each other[21]. Only a strict framework of the right explanatory model will be able to put all the found phenomena at their right spots and only then we will be able to formulate a definite answer in what exactly happens at for example the physiological level.

The essence of my writings comprises the fact that I found the explanatory model of the Motoric Movement Action[22]. It involves a complete explanation of every action at the functional/behavioural level. Although it will remain an explanation, because it doesn't provide scientific proof, it is so convincing and forcing that one will hardly be able to come to other conclusions. The explanatory model

[18] How movement is guided; D. N. Lee (2011); p. 36.

[19] In the near future I will present reviews of scientific papers and will appoint this noticed omission in regard to a functional explanation in an extensive way.

[20] Because one doesn't see that a complex system with two autonomous complex subsystems is involved it is easy to go astray. The manifestation form of the explanatory model doesn't fit within any current scientific thinking in any way.

[21] Within for example *grasp* research (Jeannerod, Smeets a.o.) researchers predominantly zoom in at the grabbing of the *object* (!) (In which I by the way will show that in common language that is possible but that grasping scientifically actually doesn't exist. Grasping comprises the in a linear script linked Motoric Movement Actions *touching* and the Motoric Movement Action *pressing/throwing*.). The positive feature of their research is for example that two different phenomena (movements of the wrist and hand aperture movements) are noticed but the only conclusion is drawn that they have to be executed simultaneously. In retrospect one will notice in the near future that what one earlier witnessed as movements of the wrist should have been appointed out of the perspective of the fingertips and belongs to the autonomous system of the movement action (MA) and that what one now sees as the main action within grasping is *just a part* (!) of the autonomous system within the motoric movement (MM). In which I don't suggest that scientific research concerning synergies within the (touch and press/throw-)technique is not important but now it will gain its definite *minor* position within the whole complex system.

[22] It is either *the* explanation or it will in no time lead to the definitive explanatory model.

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integrates all big relevant research topics within the movement sciences to one congruent, coherent etc. complete model. Important in there is to notice the fact that every scientific research which found serious resonation within the world of movement sciences gets its distinct place within the model. Like a real proof it encloses everything (or explains everything) and doesn't leave any holes.

- An essential part of the theorisation of J.J. Gibson concerning the visual perception is now fully integrated into the explanatory model. In every Motoric Movement Action the movement action (MA) as an autonomous complex subsystem is occupied with the relationship *between* (!) the animal and the environment[23]. All Motoric Movement Actions can be classified in two main groups. The catch and the throw actions[24]. The Motoric Movement Action *catching*[25] clearly shows this integration of the animal-environment relationship and that explanation also answers the most classic unanswered questions about the origins and the purpose of the visual perception organ and the motoric movement phenomenon.
- Lee's *tau*-theory and *tau*-coupling will also be placed as a structural part within the explanatory model of the Motoric Movement Action. However the findings of D.N. Lee will now be explained in one uniform set and definite way[26]. There is always one *tau*-value present in the movement action (MA) and always one *tau*-value in the motoric movement (MM). Together they always shape the *functional tau*-coupling[27]. The explanatory model will exactly show in there why and where Lee wasn't able to gain the right insight.
  The clarification of the *functional tau*-coupling remains an explanation but is so convincing that the description looks like hard evidence. The way Lee explained the *tau*-value was already admitted within science as a promising lead. With the explanatory model the whole *tau*-coupling is now defined into the last detail and completed in which the initial ideas about *a* (!) gap between "*the state you are in and the state you want to be in*" is supplemented with more and definite information. If Lee already swayed some of you partly you will completely be convinced now. Your own empirical experiences will immediately admit the explanation and will see no other explanation possible [28].

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[23] If one wants to grab/grasp something with the hand one first needs to execute the Motoric Movement Action *touching* (See: Appendix D).And that touching starts at a random place P(x) of the hand at the moment when an egocentric will is formulated. The crucial essence which flows from there is the fact that the hand then will have to bridge that animal-environment relationship from that place P(x) to a specific place $P_{(environment)}$ or P(e). So within there a line segment shape P(x) – P(e) always needs to be shaped in which it is essential that the place P(e) becomes a part of the action trajectory shape. This very complex process has never been acknowledged in current scientific *grasp*-research. In which one will be able to identify in retrospect that researchers never have seen, admitted or recognized that relationship because probably *nothing* was there to be seen. The *nothing* is maybe the most essential entity in the existence of even the earliest organisms.

[24] In here Gibson is complemented insofar that the animal-environment relationship is initiated either out of the animal towards the environment (throwing) *or* out of the environment towards the animal (catching).

[25] See: Appendix B; The Motoric Movement Action *catching*.

[26] Lee wasn't able to discover the functional *tau*-coupling because he wasn't able to recognize that the incoming ball trajectory provides the leading (*tau*)-value. For whatever reason he wasn't able to see that the ball is the actual leading entity which indeed marks *the* (!) relationship between the animal and the environment.

[27] In all catch actions there is real timing involved because the leading *tau*-value is being created by an ob-/subject which we are not able to influence. However in all throwing actions, out of the animal towards the environment, there is timing as well. It can be regarded as *self-paced* timing because in there we conversely are able to control the leading *tau*-value.

[28] Appendix A (The ball trajectory shape) will for example show that ultimate beginners or even toddlers are able to hit tennis balls or badminton shuttles. They can only execute that *hitting* with a strict *tau*-coupling as a basis. In which we one-dimensionally have to determine two *tau*-values and need to let them come to zero in a predetermined intersection point of two line segments. So even toddlers are able to establish a minimal *tau*-value within an incoming ball trajectory shape to an intersection point and simultaneously align this with a *tau*-value of a racket trajectory shape within the motoric movement (MM) to that same intersection point.
However toddlers are many years away from playing any game in which specific shapes and game intentions are involved. So the hitting as a toddler has still much more to do with the evolutionary origin of that hitting.

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- By providing the final insights in how *tau*-values are created within the Motoric Movement Action the historical action-perception dichotomy comes to its final end as well. However now it will become clear why both sides, rightfully (!), claimed to submit the truth. Once again most of the discovered phenomena within the respective scientific papers are not wiped from the table but a complementary completing insight is added in here as well[29].
- The whole dilemma of the functioning of the ventral and dorsal stream will now also be fully incorporated in the Motoric Movement Action in an unambiguous way. Till now there is still no scientific consensus about the purpose of these processing processes of the (visual) perception. However the explanation within current relevant scientific research tends to move more and more towards the explanatory model.
- The explanatory model shows a very obvious ecological explanation. It shows a clear universal approach within all Motoric Movement Actions which is based on a *simple* complex system in which two *simple* generic complex subsystems are involved. These subsystems obviously show that each system must be considered as an optimization process in which a/the body found the most optimal *parsimonious* way on the basis of efficiency and effectiveness. There are many clear commonalities with (the evolutionary development of) other organ systems. The explanatory model can be maintained even for the earliest organisms and shows a clear evolutionary way.
- The explanatory model is now assuring an ending description in which all ever noticed scientific phenomena will get a definite place. Significant within all following phenomena is that the explanatory model mainly complements those phenomena by portraying the exact framework in which they must be depicted[30]. *Flow* and playing *in the zone* within (sports) actions, Wolfgang Schöllhorn's differential learning, The Quiet Eye (TQE) theory of Joan Vickers, the *relative phase* research[31] and for example the two way split within the proprioceptive perception[32] towards *movement* and *limb position* all get their final explanation and their worthy set position within the explanatory model.

The discovery of the explanatory model is of great importance because now there is no need any more to find it. Now many scientific research wants to find that model or a part of that model. Now with the explanatory model this quest can definitely be stopped and resources can be spend on follow-up topics at other levels than the *functional* level. At other levels one will now have the ability to formulate *ending* (!) sequences of follow-up questions with a clear, unequivocal and exhaustive framework.
With the discovery of the explanatory model the puzzle of optimal motoric learning will mainly be solved as well because the explanatory model automatically will provide the most optimal (*functional*)

Namely that organisms have a higher survival rate when they are able to block incoming dangers (object trajectories) within the movement action (MA) with a movement trajectory of the body (MM) with an exact timing.

[29] Moreover that is what makes the explanatory model so powerful. Many phenomena within many scientific research papers are conversely to what one might think acknowledged within the explanatory model because those phenomena or parts of them already confirm the model. Most of the time the scientific *conclusions* drawn from these phenomena are wrong but that doesn't change the righteousness of the original found data.

[30] Of course the explanatory model completely rejects the scientific research concerning *vector coding, parameters, coordinates etc.* because these much more complex explanations are denying the essence within the explanatory model of the Motoric Movement Action. The explanatory model shows that we don't need to have any knowledge of random *isolated* points within a space because all those points are always a part of line segment shapes within the animal-environment relationship. In that way the explanatory model shows a much simpler explanation within this phenomenon which even can be linked to the earliest development of organisms.

[31] Although the explanatory model undermines this scientific research for most of its part, it does show however how the rightfully signalled phenomenon must be observed. See: "Watch The Ball Trajectory!"; Chapter 3.5.

[32] Also within this field of research phenomena are noticed in a rightful and correct way but they also are not able to formulate any functional explanation. See for example: U. Proske, S. Gandevia; The proprioceptive senses: Their roles in signaling body shape, body position and movement, and muscle force; http://web.as.uky.edu/Biology/faculty/cooper/bio350/Bio350%20Labs/WK4-MRO%20Lab/proprioception%20review%202012.pdf

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motoric learning model. Besides that it provides full access to optimize strategies within Motoric Movement Actions[33].

First I translated[34] the explanatory model in two, popularly written, books. One tennis book with the title "Watch The Ball Trajectory!" and one more general book about the Motoric Movement Action with the title *Caught In A Line.* After the publication of the books, November 2016, I also distributed them among some scientists. I realized very well that the explanatory model doesn't hold many common grounds with the current consensus in the scientific field and I was curious how it would be received. Besides the logic felt scepticism about my amateur status and my amateurish scientific language I discovered that the model is situated much too far off the current scientific reality. The explanatory model demands multiple complex *mind twists*.

a. The explanatory model does admit that one Motoric Movement Action finds its origin in one formulated egocentric will but outlines that every action comprises two autonomous parts which must be executed simultaneously. This needs the biggest mind twist. Current science observes just one undivided action. Conversely the explanatory model will show clearly that within every Motoric Movement Action one part within that action needs to be focussed on the *animal-environment* relationship conform *The Affordances Theory* of J.J. Gibson. Each and every Motoric Movement Action will always be pointed at a line segment shape, a marble run, *between* (!) the animal and the environment in which a, *empty* (!), space needs to be bridged[35].
   The explanatory model translates this part to the movement action (MA). Within every Motoric Movement Action, as well the catch actions as the *self-paced* throw actions[36], it is only occupied with an action trajectory shape, a marble run shape, *between* (!) the animal and that part of the environment that will serve as the ending point within the task of the previous formulated egocentric will[37]. If visual perception processes are involved then they are mainly occupied with the line segment shape within this part because the explanatory model mainly links the processing processes of the visual perception, the ventral and dorsal stream, to the movement action (MA)[38].

[33] From now on the game idea in every sport can be fully appointed and *flow* or *playing in the zone* will become fully comprehensible and controllable for every player.
[34] In retrospect I am now able to see that I used an *organical* approach. In the first books I mainly expressed my own *subjective* perception of all the involved phenomena. At that moment I was still unaware of for example Gibson and Lee. I first needed to give birth to these books before I was able to develop future thoughts to for example be able to translate it to current science. For me it was all so clear but I was unaware of the level of current science. I didn't know what questions they asked and in what way the answers needed to be structured. Due to feedback of a few scientists I was able to produce two addenda in which now addendum two completely translates the explanatory model to current science.
[35] In which the explanatory model complements Gibson by stating that Motoric Movement Actions are either initiated out of the animal towards the environment or vice versa out of the environment towards the animal.
[36] You are able to classify Motoric Movement Actions in several ways. One crucial classification is the division into catch and throw actions. Within catching one could say that real timing is involved. All other actions can be considered throwing actions with *self-paced* timing. In that way we *throw* a letter from the first beginning in a *precise global* letter trajectory shape. The same goes for the index fingertip when we move that tip towards a light switch. Then we throw that tip also in the beginning of a line shape towards the switch. Within both actions we are able to adjust the line segment shapes at any given moment because *we throw ourselves* and that is also the way how we are able to influence the ever present *tau*-coupling in these actions.
[37] The movement action (MA) within every action exactly appoints out of which perspective the action trajectory must be shaped.
[38] For a while science connected the processing processes of the perception only to the visual perception organ. Now they also connect them to the auditory perception organ. The explanatory model goes along with this insight and affirms that one can visualize/determine a clear action trajectory shape and a *tau*-value of a nightly mosquito. The explanatory model even goes one step further and will show that *some* (!) proprioceptive perceptions also have a set link with the processing processes of the perception.

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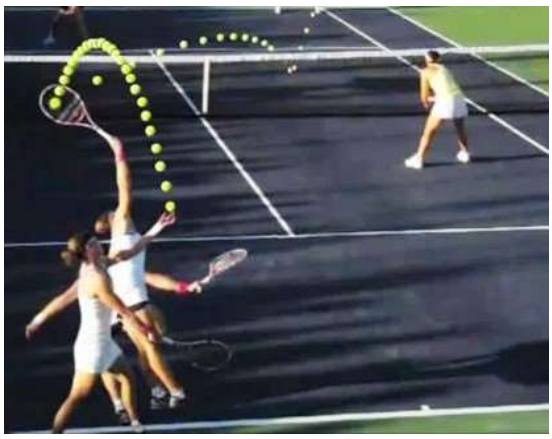
The movement action (MA) *outside of the body* is the most innovative part of the explanatory model. However you are able to determine that although it shapes an essential part of every Motoric Movement Action it doesn't fulfil anything by itself. And there we need the motoric movement process from *inside the body* which already got a lot of scientific attention. The explanatory model translates this to the motoric movement (MM) within the Motoric Movement Action. The motoric movement (MM) *executes* the movement action (MA)[39]. This is also expressed in the formula of the Motoric Movement Action: MMA = MM x (MA). Unlike the movement action (MA) the motoric movement (MM) needs to be perceived completely out of the animal in an egocentric way. And this is also how an *actor* needs to perceive this. In here mainly proprioceptive perception processes are involved.
So in every Motoric Movement Action two foci, two points of attention, are needed on two totally different processes. One needs to focus on a motoric movement (MM) within the body and simultaneously needs to concretise the action trajectory, the *marble run*, within the movement action (MA) outside of the body. Within both foci a *tau*-value arises. The linking of these *tau*-values leads to the *functional tau*-coupling. If the leading *tau*-value of the gap within the movement action (MA) approaches zero then the following *tau*-value of the gap within the motoric movement (MM) needs to come to zero as well[40]. Within every Motoric Movement Action the different kinds of perception processes inside and outside of the body always have an exact point where they are linked. Within the explanatory model this point is called the transition point.



Images: Left: The task within the Motoric Movement Action *serving* is to catch an incoming ball trajectory shape and create a service ball trajectory with an optimal game intention. The ball trajectory shape can and will only be produced by the ball. The motoric movement (MM), the serve technique, will only be able to take care that bodily movement trajectories will hit the ball into the action trajectory at the transition point (the contact point). Roger Federer needs to hit the ball into the initial phase of the desired outgoing ball trajectory shape with these movement trajectories. It is the only point of the ball trajectory which he is able to influence. Right: Within the service there is also an incoming ball trajectory which must be linked directly to the outgoing ball trajectory shape[41]. The functional *tau*-coupling in there comprises: 1. The *leading tau*-value of the closing of the gap of the incoming ball trajectory shape (the tossed ball) from a random point A to the contact point C ($tau^{G}{}_{MA\,A\rightarrow C}$) and 2. The *following tau*-value of the closing of the gap of the transition point of the racket head (the sweetspot), as part of a movement trajectory within the motoric movement (MM), from a random

[39] The movement action (MA) will fulfil the egocentric formulated will but isn't able to actually execute anything. Conversely the motoric movement (MM) is able to execute. But it isn't able to execute the egocentric formulated will directly. It is only able to execute the movement action (MA). So the movement action (MA) executes the egocentric formulated task and the motoric movement (MM) executes the movement action (MA).
[40] So this also shows how the foci need to be coupled functionally.
[41] By the way the outgoing ball trajectory shape in this photo image is a clear example of a 2nd topspin service. There is an obvious spherical/*round* outgoing ball trajectory shape involved.

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point B to that same contact point C ($tau^{G}{}_{MM\ B\rightarrow C}$). When $tau^{G}{}_{(MA\ A\rightarrow C)}$ approaches zero $tau^{G}{}_{(MM\ B\rightarrow C)}$ also needs to approach zero. However the closing of those gaps can never be perceived/executed precisely in the exact same way because they are part of two completely different entities. One needs to aim for the equal closure of the gaps as sound as possible. This leads to the conclusion that in *tau*-coupling there is never a set/fixed process but only an optimisation process in which the outcome always will be influenced by random deviations.

So although the initiative to a Motoric Movement Action involves an egocentric formulated will after this formulation one needs to regard or needs to perceive one part, the movement action (MA), out of the relationship *between* (!) the animal and the environment and absolutely not out of the perspective of the animal. That movement action (MA) then only has a relationship with the (movement) action object and not with our will[42]. That is also the way how I appointed tennis out of the movement action (MA) or the game action (GA). The game idea in tennis only involves all the positions of the ball[43] and therefore the movement action (MA) needs to be observed only out of the perspective of the tennis ball.
The ball is the (movement) action object (MA) in tennis. If we develop an egocentric will to do something with the ball than we have to comply with the demands which the movement of the ball requires. Out of the perspective of the ball. We are only able to translate the egocentric will indirectly to the line, the line shape, of the ball trajectory. Tennis players execute that game idea with *very awkward bodily* movement trajectories complemented with a *very awkward* movement trajectory of a (motoric) movement object (the racket) within the motoric movement (MM).

This exposes the first controversy with traditional, scientific, thinking. One thinks that we control the point of the pen in a direct 1:1 way during the Motoric Movement Action *writing*. Or that we bring the food to our mouth in a direct way during the Motoric Movement Action *eating*. That is not so[44]. The writing line or the line of the food doesn't even have a common relationship with the movement trajectories within the motoric movement (MM) when it comes to the direction of the lines. However they are both simple Motoric Movement Actions. We are able to permanently influence the action trajectory, of the ink or the food, any given timeframe within the movement ac-

[42] After the formulation of the egocentric will it is, as it where, taken again from the individual and replaced to a more abstract and *less subjective* place. A place between the actor and its environment. In here the explanatory model sees many commonalities with the ecological interpretation of J.J. Gibson. Gibson also centres the visual perception in the relationship *between* the animal and the environment. And not in the animal itself. Like Gibson the explanatory model appoints many latent action trajectories between the animal and all things present in an environment and calls that *the matrix*. The theory around the matrix shows a strong resemblance with Gibson's "Theory of Affordances".

[43] The Game Idea only explains the game. It doesn't explain the execution of the game. The game is played/executed with technique. So in the Motoric Movement Actions in tennis one needs to be occupied with the game of tennis and besides that with the execution of the game.

[44] A striking example of this non-directness one can find in the Motoric Movement Action *moving a cursor on a PC screen*. If you want to move your cursor from point A to point B than you will have to create an action trajectory shape out of the perspective of the cursor from A to B. The cursor is like any (movement) action object a lifeless object and a completely autonomous entity. We are only able to move the cursor by creating movement trajectories within the body which will move the mouse. The moving of the action object, the cursor, in this case is mediated by a set intermediary constellation. Because a PC uses a software program which isn't disturbed by any intention of the movement trajectories. The transition point is therefore situated *between* 1. the end of the movement trajectories inside the hand which will touch the mouse and 2. the outside of the mouse that will be touched by the hand. In this Motoric Movement Action it seems that the movements of the mouse correspond with the movements of the cursor but that is an illusion. The cursor is moved by means of a complicated computer program which has nothing to do with movement trajectories or with any line whatsoever. It *translates* movements of the mouse towards movements of the cursor. You don't really think that we move a cursor 1:1, do you? You also don't think that we talk over the phone with somebody at the other side of the world 1:1?

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tion (MA) and the demanded technique within the motoric movement (MM), even with a (motoric) movement object (spoon/pen), remains quite simple. So in spite of the aforementioned complexity we are capable to write and eat in complete flow because we are able to fully focus on the action trajectory. This flow also occurs due to the fact that we own a huge amount of abstract knowledge concerning possible action trajectory shapes within eating and writing[45]. Probably you are able to realise this flow while writing. With your dominant hand you think that you construct nice direct 1:1 lines[46]. Writing with the other hand will probably show that you are not able to translate the equal perceptual image of a letter/word shape into a qualitative equal shape on a piece of paper. A fact that you also could have had while eating with the non-dominant hand.

b. These facts lead to the determination that even the simplest Motoric Movement Action can't be appointed as a linear process anymore. Each action must be assessed as a complex system. Within the Motoric Movement Action perception processes need to be occupied with two complex subsystems. That is expressed in the formula MMA = MM x (MA). A successful execution of one Motoric Movement Action depends on the optimization of one motoric movement (MM) and one movement action (MA) which must be executed simultaneously. Linguistically the term Motoric Movement Action has been chosen in such a way that the components would show the word movement twice. This is the translation of the essence of the Motoric Movement Action. Namely that we have to see or to bring movement in the (movement) action object which we don't control directly with movements out of the body which we do control[47] in a direct way.
What we are able to label as linear is the fact that both subsystems are, *Caught In A Line*, caught in line segment shapes. As long as we are not able to execute any *time jumps* all places P(0) of an (movement) action object or a motoric movement will be linked to the places P(+1) and P(-1)[48]. So all the action trajectories and movement trajectories are shaped in a linear way. If one is capable to create a perceptual image of the latent parts of those lines with the help of cognitive knowledge one is able to create an image of the closure of that line with the manifest part of it. So on the basis of knowledge about inertia, ballistic behaviour etc. one is able to create a (*tau*-)value (tau^{Gap} or tau^{G}) of the specific line segment at hand.
If you already had problems with point 1 this will be even harder to accept. However if you would be willing to study the motoric learning instructions of the Motoric Movement Action *golf putting* and *free throw (basketball)*[49] than you would be able to see that this division in two parts must lead to two foci.
By the way this statement about multiple foci expresses precisely the complexity I felt for decades while executing a Motoric Movement Action but which I was never able to put in words. If you would now toss anything (an apple?) between you and a partner you instantly would be able to experience that same complexity. In the catching process you are occupied with visual perception processes concerning the apple trajectory and at the same time with proprioceptive perception processes to place the hand at the end of that trajectory. It doesn't matter how many times you will toss the apple between you and that partner according to your senses it will remain an *uncertain* process due to the two foci.

[45] See: Addendum 1; Appendix B; The Motoric Movement Action *writing*.
[46] See: Addendum 1; Appendix D; The Motoric Movement Action *nerve spiral*. The nerve spiral shows that during the execution of a Motoric Movement Action we are caught between the two processing processes of the visual perception and that we are not able to produce straight lines because of that.
[47] The two sorts of movements also show the essences of the functional *tau*-coupling. For the timing we need to visually (*auditorily-mosquito*) observe the gap of the movement within the movement action (MA) which we are not able to control and at the same time align that with the gap within the motoric movement (MM) we conversely are able to control.
[48] See also: Appendix A; The ball trajectory shape.
[49] See: Addendum 1; 1-3 and 1-4.

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> The complexity you experience in that process also has to do with the aforementioned *tau*-coupling of the timing of the actions. The *tau*-value of the apple trajectory within the movement action ($tau^{G}{}_{MA}$) is leading and must be observed with actual vision because we don't have a physical bond with it. The *tau*-value of the biomechanical main action[50] towards the transition point within the motoric movement ($tau^{G}{}_{MM}$) which we do proprioceptively control must follow that leading *tau*-value[51]. For a successful catch action both *tau*-values need to approach zero simultaneously at the exact same (catch) point. That leads to a unique optimization process within every new catch action.

These two points I recently addressed in a research proposition in which The Quiet Eye (TQE) is opposed to The Active Eye (TAE)[52]. If one understands or executes the research proposition one is able to see that that the complexity of the two foci will provide the same gaze as the gaze which TQE regards to be the cause of acting successfully. The appointed very active perception processes within TAE leave no doubt about the fact that gaze is the effect and not the cause of the execution of a Motoric Movement Action. Albeit, and that is the very complexing factor in clarifying the explanatory model, it is the effect in the performance of elite players while executing complex to very complex Motoric Movement Actions (mainly sports, juggling etc.). In simple Motoric Movement Actions (eating, writing etc.) everybody is mainly occupied with the action trajectory[53]. In complex actions just a few elite players find the whole way of the action trajectory shapes. The formula MMA = Te x (GA)[54] also does show that. The execution of a Motoric Movement Action is optimized by two elements. In tennis it is therefore possible, and to be seen every day at the tennis courts, that for example an elite player is able to compensate lesser knowledge about the game with a superior technique. However, although elite players of that last category must have some implicit knowledge of ball trajectories, the formula clearly shows that it is still possible to act at an elite level without explicit full knowledge of the relevant action trajectory shapes. It is still possible because till now there are no methods to provide players with explicit knowledge. Because in principle everything can be learned about the action trajectory shapes from now on a player who will not own that knowledge in the near future will fall far behind his colleague with that knowledge. So to this moment the clarification of the explanatory model is hampered by the fact that there are many hybrid manifestations of the execution of the Motoric Movement Action in complex sports.

Still the reactions to addendum one, which mainly focuses on the manifestation form of the whole explanatory model of the Motoric Movement Action, were from such an order that I got the strong impression that people especially have a lot of difficulties to understand the functioning of the movement action (MA). This separate complex subsystem indeed demands a few very important separate mind twists as well. People find it hard to imagine that a perceptual image of a latent *marble run* out of the perspective of the (movement) action object is involved in every Motoric Movement Action. Till now the ball trajectory or object trajectory shape has been mentioned in some scientific research and some learning methods but it was always a side remark/issue. There were *consequences for the ball trajectory* or *one is able to distract information from the ball flight* but it was never appointed as an important part. The explanatory model appoints this part as the main leading ingredient of the Motoric

[50] The biomechanical main action needs to focus on the movement trajectory shape over which the transition point within the catching hand is moved.
[51] For an extensive explanation see appendix B; The Motoric Movement Action *catching*.
[52] This research proposition is now called addendum 1. Addendum 1 is now one document with four parts. 1. The research proposition TQE versus TAE. 2. The appendices; with mainly Motoric Movement Actions with a visible action trajectory. 3. The motoric learning instruction *golf putting*. 4. The motoric learning instruction *free throw (basketball)*.
[53] Everybody eats and writes in *pure flow*.
[54] Is equal to MMA = MM x (MA). But it is the specific formula for sports/games. *Te* stands for *Te*chnique. GA stands for Game Action.

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Movement Action[55] and a lot of scientists will have a lot of troubles with that assumption[56]. And within there with the fact that a marble actually creates its marble trajectory but is also bound to follow a sound visualization, a sound perceptual image, of a latent marble run. A sound perceptual visualization is able to cast the shadow forward to future places of a (movement) action object and makes it possible to create a relationship between the actual place of the marble and the latent part of the marble trajectory.
In all Motoric Movement Actions we always create a top-down image of a global latent action trajectory shape[57]. This global image can't be precise in the beginning but that is not necessary then. The only important thing in the first phase of a catching action for example is that the biggest and grossest motoric movements (MM) are executed[58]. The perceptual image of a latent action trajectory shape then functions as a blueprint in which the fluctuations of possible deviations of a flexible *marble run* are indicated. The fluctuation borders of possible deviations of the action trajectory shape will mainly try to lead the limiting of the possibilities, within very strict and narrow margins, within the (*generic and limited* (!)) motoric movement (MM). That is why it is necessary that the biggest and grossest movement trajectories are executed in the earliest phase of a Motoric Movement Action. Especially in fast complex sports like tennis or cricket. In combined catching and throwing tasks one needs to start realising that set perfect processes do not exist. Every single Motoric Movement Action is a unique, always uncertain, optimization process[59].
Although the aforementioned top-down process is essential for most fast complex sports the actual execution also needs bottum-up (on-line) perception processes. Only the actual place of the (movement) action object during the actual execution defines the actual action moments. Because each (movement) action object, unlike a set classic marble run, is able to and will deviate at each place P in the action trajectory. The possible deviations must actually be perceived till the end of the Motoric Movement Action and be compared with the perceptual image of the latent action trajectory shape. If an elite player wants to execute a Motoric Movement Action with a high success rate he first needs to follow the perceptual image with such preliminary motoric movements (MM) that will make it possible that the deviations within the last part of the action trajectory shape still remain well within the *fluctuation boundaries* of the concluding motoric movements (MM)[60].

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[55] This whole addendum but especially the appendices A and E (The ball trajectory shape and The Motoric Movement Action *cat and mouse game*) will clearly show the borders and nuances within our perception processes. Especially the description of the perception processes within the use of a Z-ball will clearly show all the nuances within the whole spectrum of catch actions.
[56] Probably one could later determine that in retrospect the lack of this essential insight withheld us from discovering the leading *tau*-value within the functional *tau*-coupling.
[57] I will address the relevance of this later. In short the shaping of a top-down image is much more important in complex Motoric Movement Actions. In simple Motoric Movement Action it doesn't look relevant but this is just the way the body executes all actions. Even in the simplest actions we create an image of a latent action trajectory shape.
[58] Only then the motoric movement (MM) will be able to cover the fluctuations of any near future deviations in the action trajectory. When in for example tennis I sprint to the forehand corner I will never be able to predict the precise end of the incoming ball trajectory but then I keep the possibility to cover future deviations in an approaching ball trajectory to that corner. If I don't make that sprint in the first phase I will never be able to cover near future, upcoming, deviations within the fluctuation possibilities of the motoric movement (MM) if that ball actually reaches the corner.
[59] For example tennis players should learn that there is always an error rate because of the inherent deviation possibilities of all parts. That should lead to the realistic awareness that mistakes are just part of the job and that you only should, are able to, aspire to keep the error rate of all parts as small as possible.
[60] In nowadays power tennis the sweet spot of a racket first needs to be moved far from the contact point (the intersection point of the incoming ball trajectory and the outgoing ball trajectory) to gain potential energy. A player must be able to bring back the racket in such a way that the fluctuation of possible deviations of the ball in the end phase of the incoming ball trajectory can be covered easily within the fluctuation possibilities of the hitting technique (or the biomechanical main action of the motoric movement (MM)). During that process the leading *tau*-value of the action trajectory must be followed and aligned with the *tau*-value of the motoric movement (MM).

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Besides the perception of complex (line segment) *shapes* one is able to determine the one-dimensional closing of a gap within a perceptual latent *line* (segment shape) by the actual position of the (movement) action object. Within there one is able to perceive that the gap between the actual position of the (movement) action object and the perceptual end point of the latent image of the action trajectory shape will become zero. This will create the leading *tau*-value within the movement action ($tau^{G}{}_{MA}$) and this value needs to be aligned with the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$) within the *functional tau*-coupling which will arise in every Motoric Movement Action. The explanation of *tau*-values and the *functional tau*-coupling is a compelling explanation. If you want to understand these phenomena you will simultaneously have to end the perception-action dichotomy and you will have to accept that they both inevitably must be present and within there you will in retrospect have to acknowledge that they both were *just a part* (!) within a larger, never acknowledged, phenomenon.

In this document, addendum two, I will appoint the aforementioned phenomena into more detail and by doing so I hope to appoint the whole functioning of the movement action (MA).
However the appointing of a complex system is a complex case. A clarification in writing is especially well-suited for the description of linear processes but not for complex ones. So I want to ask you to approach this addendum as a complex system and with that in mind I created a general part and separate appendices. In which the appendices as autonomous parts play a much bigger role than they usually do. One could say that all parts play a leading role conform a complex system. In the general part I will refer to the appendices on a regular basis and I hope that you will look into them and study all the parts as a complex system. Besides the fact that they all clarify different essential aspects they also continuously confirm the universal character of the explanatory model of the Motoric Movement Action and that again enhances the eloquence of the individual appendix.

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Chapter 1 – The movement action (MA)

The Motoric Movement Action (MMA) must be appointed as a complex system and comprises two, autonomous, complex subsystems. The motoric movement (MM) and the movement action (MA). They have to be executed at the same time for a successful execution of one Motoric Movement Action. The formula MMA = MM x (MA) gives expression to that complexity. The formula shows that the movement action (MA) is the leading and an autonomous phenomenon. In essence the movement action (MA) fulfils the egocentric formulated task at hand. The way how that task is executed is called the (movement) action idea or the action idea. In sports/games I specified this to the game idea. The movement action (MA) must be appointed out of the perspective of the (movement) action object or the action object. All places P of the action object do follow each other in a linear way and are *Caught In A Line* as it were[61]. An action line shape or an action trajectory. However the (movement) action object doesn't do anything by itself and we also are not able to control it in a direct way[62]. We are only capable to move a (movement) action object in an indirect way with the help of movements of mainly muscle groups within our body. So the movement action (MA) only explains the action idea. The motoric movement (MM), with its respective (motoric) movement idea or movement idea, must execute that action idea. In sports/games the movement action (MA) only contains the *explanation* of the game. The game can only be played/executed with technique/motoric movements.
In spite of the fact that we are able to clearly separate the two parts they must be executed at the same time in one Motoric Movement Action. This leads to the novum in movement sciences that multiple or at least two foci are involved in one Motoric Movement Action because both parts strenuously demand attention. The leading role of the movement action (MA) is awarded by the explanatory model with the primary focus. The motoric movement (MM) mainly follows the movement action (MA) and therefore is awarded the secondary focus. The primary focus is mainly occupied with the action trajectory. The secondary focus must be pointed at the leading body action[63] within the motoric movement (MM) towards the transition point with the action trajectory. The description of the two simultaneous working foci exactly display the functional *tau*-coupling within the Motoric Movement Action.

The explanatory model distinguishes three parts in the movement action (MA)[64]. The cognitive basis, the tactical movement action and the actual movement action. They have the common goal to come up with just one action trajectory and to execute that one action trajectory. It doesn't matter how weird one constructs an action trajectory, within one Motoric Movement Action only one action trajectory shape will be executed. One whole marble run with a beginning, a middle and an end and all points P in between.

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[61] See appendix A; *The ball trajectory shape*.
[62] It is like the water in a mountain stream.
[63] Within the explanatory model this is called the biomechanical main action.
[64] I will get back to this trichotomy during the functioning of the movement action (MA). But I want to add in this stage that I didn't especially invent this. It is just the logical consequence when you start to realize that we create images of action trajectory shapes in all Motoric Movement Actions. Then there must be a basis with all kinds of trajectory shapes of all kind of actions and of the specific Motoric Movement Action at hand. In the same logic way a tactical movement action must specify this general information to the specific environment of the relevant case. The cognitive basis and the tactical movement action are part of the tactics department and will need to supply one shape of a latent action trajectory before the actual execution of the action. It is also logical that the actual execution takes place during the actual movement action in which the *tactical department* stays alert.
So although I will come back to this topic I don't think that there is not a lot that needs actual proof. I think it is a logical consequence of former assumptions. If conversely scientific proof is demanded then I refer to the growing number of descriptions of specific Motoric Movement Actions. The three components form the constant basis within each description and always need to be interpreted in the exact same way. It shapes one constant universal phenomenon within all Motoric Movement Actions.

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a. The cognitive basis (MA)

Because all Motoric Movement Action are executed with the help of action trajectories we possess a huge base of line shapes over which an action can be unfolded[65]. This huge basis has no big relevance under normal conditions[66] but will take care that under special (emergency) conditions we are able to become maximally creative. We are able to reach for a *high* cooking pan with the help of a kitchen ladder or a soup ladle but we are also able to combine these two in the case of a *very far and high* cooking pan[67].

I considered to call the cognitive basis the *general* tactical movement action. This would make the tactical movement action the *specific* tactical movement action. However I do think that our basic knowledge comprises a mixture of all action trajectory shapes of all Motoric Movement Actions and not only the abstractions of one specific action.

b. The tactical movement action (MA)

Image: The classic game of *Twister*. According to the outcome of a colour swivel plate a certain body part must be placed [68] on a certain colour. During that task you are not allowed to touch other participants. The tactical movement action will have to continuously weigh the many possible action trajectories in relationship to the constant changing variables of the environment and will finally have to come up with a choice for one action trajectory. Because in one Motoric Movement Action only one action trajectory shape can and must be created. When a final choice is realized the actual movement action just will execute that one action trajectory without any tactical judgements later on.

[65] In here the explanatory model associates itself completely with Gibson. "Psychologist James J. Gibson originally introduced the term in his 1977 article "The Theory of Affordances" and explored it more fully in his book The Ecological Approach to Visual Perception in 1979. He defined affordances as all "action possibilities" latent in the environment, independent of an individual's ability to recognize them, but always in relation to agents (people or animals) and therefore dependent on their capabilities (https://en.wikipedia.org/wiki/Affordance)."

[66] Action trajectories towards my coffee cup or towards my light switch just beside my chair are rarely blocked by something or someone. Also within the Motoric Movement Action *letter posting* I was always able to execute the action trajectory in a unrestricted way.

[67] I don't know why but suddenly I also thought about the *urinella*. https://en.wikipedia.org/wiki/Female_urination_device.

[68] The basis of this game is formed by the Motoric Movement Action *touching/grabbing/taking etc.*. Appendix D will reveal all functional processes which are involved in there. From there you are able to deduct on your own how the Motoric Movement Action *walking* is linked to the Motoric Movement Action *touching*.

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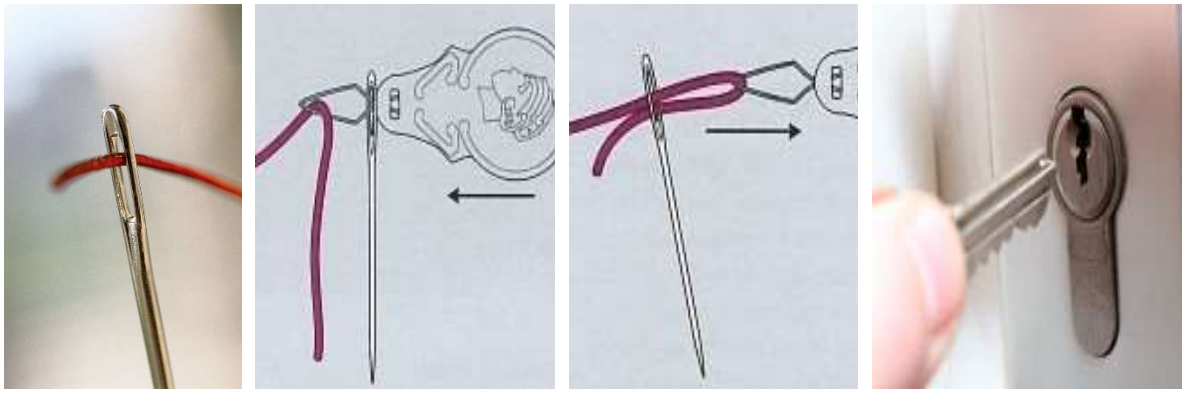
Before we are going to execute an action the general knowledge of the cognitive basis must be opposed to the actual circumstances and the specific Motoric Movement Action of that moment which needs to be executed. At the end of that process there finally needs to be made a choice for one specific (latent) action trajectory shape. It is obligatory because it will have to lead the actual movement action[69]. The cognitive basis and the tactical movement action shape in this way *the tactical department* of the movement action (MA) and this department serves the actual movement action.

c. <u>The actual movement action[70] (MA)</u>

The tactical movement action is in service of the actual movement action but the actual movement action only executes the within the tactical department chosen action trajectory. Within for example the Motoric Movement Action *grabbing/taking/touching* (with the hand) the hand is thrown into the beginning of the chosen action trajectory shape and will be adjusted in an ongoing mutual process due to the processing processes of the visual perception. The ventral stream mainly observes (the manifest and latent part of the) action trajectory but with a relationship to the actual place of the hand. The dorsal stream mainly observes the actual place of the hand but with a relationship to the (manifest and latent part of the) action trajectory[71]. As soon as the (movement) action object, the hand or rather the specific fingertips which will touch something, deviates from the *action path* the tactical department will have to come up with a new perceptual image of the latent action trajectory right away which the *marble* is obliged to follow again. This ongoing mutual process will only stop when the Motoric Movement Action is fully completed.



Images: The task to thread a needle successfully hardly tolerates deviations of the action trajectory. The (movement) action object is in this case the tip (!) of the thread and the action trajectory runs from there, invisible, to the eye of the needle. In many attempts this tip will end on the edge of the eye or

[69] Like I mentioned before we also follow this pattern in simple actions. One could argue that it isn't necessary in there. The conclusion however is that our body just always performs every Motoric Movement Action in that way. Even in the simplest action. In complex sports however just a few elite players find the whole model.
[70] In tennis the game idea is twofold. A player has the task to create chains of ball trajectories. The second task is to withhold the opponent from fulfilling that first task. The tactical movement action is mainly occupied with the latter task and is busy to judge ball trajectories for their intrinsic tactical value. The actual movement action only has to link the incoming ball trajectory to an outgoing ball trajectory shape without any tactical judgement. That is one of the new insights. Tennis is characterized as an open skill sport but at that point tennis is a very closed sport where shapes needs to be linked with very precise technique. Tennis owns a comprehensive Tactical *Tennis* Action and Actual *Tennis* Action. You can read all about it in "Watch The Ball Trajectory!".
[71] I think it is obvious that the actual place of the hand will define the actual action moments.

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will even pass the edge on the wrong side. A sewing aid (images in the middle) will enlarge the opening of the eye of the needle 5 to 10 times and will turn this task into a child's play. The continuous but very small deviations, caused by the motoric movement (MM), of the action trajectory will then be covered easily within the fluctuation possibilities of the sewing aid. Notice in here the commonalities with the key and the lock. The action object is in this case the front part, the tip, of the key and no other part. The action trajectory is shaped out of the perspective of that tip. Because a key needs to fit almost 1:1 there is also hardly any room for deviations of the action trajectory. That is why the front of the key has a point shape and the lock is equipped with a little spherical cavity at the place where the point of the key must be inserted. Besides these things we often use a *non-key* finger of the *key hand* within the motoric movement (MM) to create a fixation[72] with the door with the goal that the key fingers will become less vulnerable to deviations. It all has the same goal as the sewing aid. Namely to maximally cover the fluctuation of deviations within the action trajectory shape. So under normal conditions you need actual vision till the very end in both tasks. However with the complete explanatory model you will now be able to explain that you probably will never be able to execute the thread and needle task in the complete dark but that the key and lock task can be executed quite easily in there. But for now I leave that answer to you.

> That doesn't mean however that you need direct vision till the end of the process. Like I will explain in the functioning of the movement action (MA) this depends on how possible deviations in the action trajectory can be covered by fluctuations of the motoric movement (MM). If I reach for the tiny light switch just beside me than I will be able to take away my actual vision at a considerable distance because I will be able to cover possible deviations within the action trajectory easily within the fluctuation possibilities of my hand. Deviations of action trajectories decrease exponentially and besides that the tiny light switch of my lamp fits about a hundred times into my hand. Even if my hand really deviates in the last part of the action trajectory the size of my hand as compared to the light switch will be able to cover that easily. That is very different when you want to thread a needle. Sometimes diameters of threads are even bigger than the eye of the needle (make it wet!) but let's assume that the ratio eye-needle is between 1:1 and 1:2. Than the eye hardly allows any deviations of the action trajectory and you will not be able to cover them easily within the motoric movement (MM). You will need actual vision to the very last moment of this Motoric Movement Action. And still the error rate will be significant. That is partially because we are not able to create straight movement trajectories in a direct 1:1 way[73].

It is important to note that the aforementioned parts within the movement action (MA) come to the stage linearly but that they don't exit that way. When deviations in the action trajectory occur within the actual movement action the cognitive basis and the tactical movement action, the tactical department, must be alert at all times to provide new perceptual images of the latent part of the action trajectory. They stay alert till the Motoric Movement Action is finished.
The explanation of the actual movement action, and within there the functioning of the *tau*-coupling, will end the dichotomy about which sort of perception processes are mainly at work. The actual movement action definitely shows that one Motoric Movement Action can only succeed by the strict cooperation of top-down and bottom-up perception processes.

[72] When starting a car the fixation of the action trajectory shape between the tip of the key and the ignition switch is achieved by the set position of the chair towards the position of the switch. So within a very short period of time we don't need actual vision during the shaping of the relevant action trajectory within our own car.
[73] See: Addendum 1; Appendix D; The Motoric Movement Action *nerve spiral*.

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Chapter 2 – The (movement) action object (MA)

Within the movement action (MA) the action trajectory is created by the movement action object or the action object. The involved action trajectory is a very specific, unique, line shape over which the action object is moved from A to B. Before further addressing these unique shapes I will first appoint the different categories of (movement) action objects. All Motoric Movement Actions can be appointed out of the explanatory model and only contain three kinds of objects. The explanatory model distinguishes:

a. Action trajectories with concrete objects

   Concrete objects like the ball in tennis/basketball/golf etc., the letter during the posting process, the ink in the Motoric Movement Action *writing*, the wine in the Motoric Movement Action *pouring*[74], the food in the Motoric Movement Action *eating* etc.. With this notion that the tennis racket in the game of tennis is a (motoric) movement object and adds an extra movement trajectory to the motoric movement (MM). But if a player throws the racket out of anger towards the court surface or towards the referee it becomes a (movement) action object right away. The same can be applied to the bottle. While pouring it is also a flexible (motoric) movement object but when a vessel is baptized the bottle also becomes the action object. The distinction in there is if the object fulfils the essence of the task itself or if it only helps during that task.

b. Action trajectories with a part of the body

   Like the (outside of the) finger tips in the Motoric Movement Actions *touching a light switch* or *playing the piano*. The (outside of) the hand, foot, elbow, bum etc. while closing the door of the fridge. All legitimate (outside parts of) body parts which a martial arts athlete can use to make techniques. The taking/grabbing/touching with the (outside of the) hand of all kinds of objects like mugs, water kettles etc..

c. Action trajectories with the whole body

   This category definitely contain the Motoric Movement Actions *walking/running/swimming/diving/jumping etc.* when they are executed without a concrete object. The explanatory model also categorizes in here other Motoric Movement Actions with a concrete object but which also have the main goal to just move from a random point A to a random point B. So this category also contains the Motoric Movement Actions *rowing/driving/racing/biking/riding horseback/skating/sailing/flying/bob sleighing etc*.. In general the explanatory model calls these actions the Motoric Movement Action *moving A-B*.
   In this addendum I will not appoint any *moving* action in which the sole task is to just move from A to B. The moving which is appointed in this addendum is only a minor part within a bigger task[75].

All action trajectories relate to a specific line shape which must be observed out of the perspective of the movement action object. The explanatory model tells us that we also execute all simple (daily) Motoric Movement Actions implicitly with the help of a perceptual image of a latent action trajectory.

[74] The Motoric Movement Action *writing* and *pouring* are part of addendum 1; Appendix B and C.
[75] For more information about the Motoric Movement Action *moving A-B* see: *Caught In A Line*; Chapter 4.3.

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However they are so simple that we don't realize this. We execute them in *pure flow*. In complex ball sports in which a catching task must directly be combined with a throwing task most people don't reach that level of execution. Because of this it is hard to illustrate that we use action trajectory shapes. However there are a few Motoric Movement Actions in which the action trajectory becomes visible[76]. A nice example is the Motoric Movement Action *writing*. It shows very clear action trajectories and demonstrates precisely that we own a huge base of specific, subtle, knowledge of line/letter shapes. This huge base allows us for example to produce all kinds of letter sizes and to connect them in many separate ways. Or makes it possible to decipher fast written scrawls in a doctors recipe.
I will show in the next part that we do own an equal amount of action trajectory shapes within the Motoric Movement Action *grabbing/taking/touching etc.*. This action is a very basic and important Motoric Movement Action and that is why it is the object in many research studies. I will also outline why this knowledge always has escaped our attention. In short that is because we create, non-visible, action trajectories in the open space, *the nothing/void*, of the environment and that is never noticed by *eye-tracking-gear*.

[76] See the appendices of addendum 1; Motoric Movement Actions with a visible action trajectory.

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Chapter 3 – The action trajectory of the movement action (MA)

a. The *tau*-value of the movement action ($tau^{G}{}_{MA}$)

One very important new insight within the explanatory model is the fact that we always create an action trajectory shape within the movement action (MA) of simple Motoric Movement Actions out of the perspective of the (movement) action object. That is not just a vague line connecting a beginning and an end but again and again that is a unique, full-fledged, line shape about which we own a vast amount of knowledge. If we compare it once more with a marble run than it concerns not only the beginning and the end of the run but the whole route. So within the classis marble run we possess exact information about the turning points when the marble hits the walls and changes its direction. These are for example the special inflexion points of this simple action trajectory shape.
This is an essential part of this addendum and probably a part where your way of thinking is at a remote distance from the explanatory model. The weird and a little bit funny fact however is that you do that already in every simple Motoric Movement Action you execute. But the actions in these kind of Motoric Movement Actions are so simple that you create them implicitly/unconsciously. So you just don't have a clue that you actually create them.
However it is essential that you start to see that 1. there is an action trajectory shape involved, 2. that it indeed is created out of the perspective of the (movement) action object and 3. that during the execution we first create a perceptual image of the whole action trajectory shape. Only then you will be able to see that during the actual movement action a set relationship will occur between the manifest line and the still latent part of it. Exactly in there the gap is situated which will provide the leading *tau*-value ($tau^{G}{}_{MA}$) within the Motoric Movement Action. The *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) will have to follow this leading gap. This relationship also allows that you are able to produce precise global statements of the shape of the end of an action trajectory when an action trajectory is just being created. And that makes that we are able to anticipate from the very beginning of an action trajectory shape with gross motoric movements. They can and must only be gross motoric because at that stage we don't have exact information about the end of the action trajectory shape. When the action trajectory becomes more manifest the perceptual image will develop into a very precise prediction and so the motoric movements can develop from *global* to very precise.

b. Assignments – The shape of the action trajectory

To convince you of the existence of action trajectory shapes I came up with the following assignments. They will show that the whole action trajectory shape is involved and that the action trajectory shapes within for example the Motoric Movement Action *grabbing/taking/touching*[77] show at least as many differences as the action trajectories within the Motoric Movement Action *writing*.

[77] The Motoric Movement Action *grabbing/taking/touching* is more generally appointed in appendix D.

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I hope you will actually execute the next assignments. The Motoric Movement Action *grabbing/taking/touching etc.* is involved. The egocentric formulated task is to grab a coffee mug or tea glass. The different directions of the hand grips are an essential part of the assignment. Because a hand grip on the right side is able to show lots of nuances of the direction of the hand grip it is necessary that you at least evaluate this limited supply of directions as shown in the pictures above.

Assignment 1

In the first assignment you are allowed to execute the Motoric Movement Action *grabbing/taking/touching etc.* freely. If you compare the involved action trajectories, after execution, than you will notice that each hand grip is approached in a specific way. Out of the perspective of the (movement) action object, the fingertips that will touch the grip, you create action trajectories which each time have the same goal but differ in shape just like the characters in the Motoric Movement Action *writing*. You will be able to notice crucial differences within the motoric movement (MM) within the execution of every action trajectory. The whole arm is involved in this process and continuously shows clear differences when you approach the hand grip. Striking differences can be noted in the abduction/adduction of the upper arm and the palmair/dorsal flexion of the hand.

Assignment 2

In the second assignment you have to block the coffee mug/tea glass with optionally 1. two transparent glass vases, 2. a grocery bag or 3. a transparent glass plate.



Images: It is important that you start to notice that our gaze indeed is pointed at the hand grip[78] but also or more importantly is pointed at the *nothing* between the fingertips and the hand grip. When we notice anything there we immediately look for another whole shape which will guarantee a free passage of the (movement) action object (the hand) towards the grip.

When you compare the involved action trajectories you notice that the goal hasn't changed and you notice that you automatically, without creating any explicit thoughts, determine other successful action trajectories. So within all of the stances of the mug/glass you implicitly shape a perceptual image of successful line shapes from the action object to the grip. Out of all possibilities the tactical movement action will force you to pick only one of them which you will actually have to execute during the actual movement action. Just like in assignment 1 the action trajectory shapes look similar but again accommodate many characterizing subtle differences.

Assignment 3

[78] Like I will appoint in the upcoming review of T. Foulsham's paper.

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The third assignment needs a lot of your phantasy. The goal remains to grab a mug/glass but now you have to introduce an action trajectory of a third moving object/subject which could obstruct an undisturbed execution of your action trajectory. You can do this by imagining a screaming and running child in front of the mug/glass. Or you can do this by assembling a working chain saw to the ceiling which moves from side to side in a regular steady pattern.

If you execute the assignments 1 and 2 under this new condition the former constructed action trajectory shapes will not be influenced. So that is not the goal of this assignment. This assignment is created to show that the timing of our action trajectories will be influenced by other action trajectories of other subjects/objects in the environment. In road traffic we experience that on a daily basis.

c. The *tau*-coupling within the Motoric Movement Action *traffic*

Assignment 3 is a far sought assignment to show that we assess action trajectories of other participant in our daily actions indoors like we assess action trajectories in road traffic outdoors. In here I will briefly appoint the Motoric Movement Actions *in daily road traffic* and the relevant *tau*-coupling. First it is important to understand that the functional *tau*-coupling within the timing of the Motoric Movement Actions is based within the Motoric Movement Action of one road user itself. Each vehicle in the accompanying images below is familiar with its own autonomous Motoric Movement Action and within there with its own *tau*-coupling. So the functional *tau*-coupling has nothing to do with other traffic participants.
Each vehicle from bike to car is characterized by the fact that the action trajectory is created by its own (motoric) movement object which only can be influenced by a set intermediary constellation[79].
The transition point within for example a car is therefore situated, within the legs, between 1. the outside and the bottom of the sole of the shoe which will touch the relevant pedal and 2. the outside of the pedal that will be touched by the shoe.
The line segment over which, the transition point of, the specific pedal can be moved determines the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$). Just like within most other Motoric Movement Actions we don't have to perceive this *tau*-value with direct vision. Certainly in driving a car we perceive this in a proprioceptive way. Just like within most other Motoric Movement Actions we do have to perceive the *tau*-value of our action trajectory ($tau^{G}{}_{MA}$) with direct vision. So if we suddenly have to queue behind another car the distance of the line segment between our car and the car in front of us determines, the gap or the latent action trajectory shape. When we observe the closing

[79] In determining the transition point of a (motoric) movement object it is essential to know whether the object is flexible (f.e. spoon, tennis racket etc.) and adds an extra movement trajectory to the motoric movement (MM) or whether the object must be qualified as a set intermediary constellation (f.e. computer, car etc.) and that the object doesn't add an extra movement trajectory. See also *Caught In A Line*; Chapter 3-4 and 3-5.

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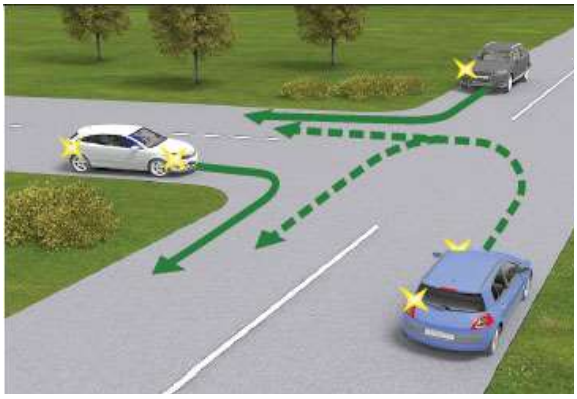
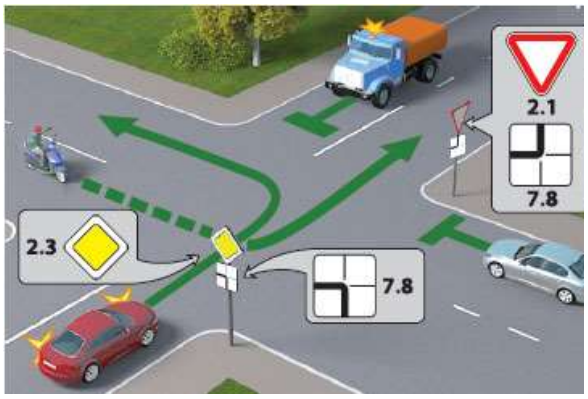
of this gap we are able to determine the leading *tau*-value of the movement action ($tau^{G}{}_{MA}$). The *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) will have to follow the leading *tau*-value within the execution of one specific Motoric Movement Action with one vehicle. Or with other words the brake pedal foot will need to put pressure in such a way to the pedal that it will correspond with the possibilities which the distance between the two cars offer ($tau^{G}{}_{MA} \approx tau^{G}{}_{MM}$).





Images: In daily road traffic we continuously use the fact that other participants are *caught in a line*. Our perception processes in daily traffic especially observe the latent parts of the action trajectory shapes belonging to the present vehicles. This looking at *nothing* is an important function of the perception processes in all Motoric Movement Actions because in there we visualize the latent action trajectory of our own Motoric Movement Action *moving A-B*.

The other road users produce their own action trajectories with their own *tau*-coupling like moving children or moving chain saws in a kitchen. So they don't form a *tau*-value which has a direct consequence for the egocentric formulated task within your own Motoric Movement Action. Fortunately we don't have to actually catch other participants in daily traffic but we only have to avoid them. That is why they will not become a part of the functional *tau*-coupling within the actual movement action. The *tau*-values of other participants only need to be judged marginally during the tactical movement action[80]. Therefore we only need to perceive the *tau*-value of the action trajectories of other road users (A, B. C etc.) and to take care of the fact that they don't collide with the timing of our own action trajectory ($tau^{G}{}_{MA\ (own)} \neq tau^{G}{}_{MA\ (A,\ B,\ C\ etc.)}$)[81].

Assignment 4

What I want to explain in this assignment I am not able to illustrate very well with the grabbing of a mug/glass. Therefore I use a completely different example.
Within assignment 4 I let you make a basketball throw within a basketball setting. Though I will lead you to a new basketball hall for every new throw. While changing halls it is your task to completely forget the previous ones. So you must reset yourself like it is the first time every new shot. I could let you shoot at the basket from different places in the hall at specific heights of the basket but the goal of this assignment becomes very clear if I lead you into halls where the ceiling differs in height. If I ask you to shoot at the basket and a possibility remains to get the ball between the ceiling and the basket then you, implicitly, will look for a successful ball trajectory shape. Probably you are going to experiment with all kinds of throws with one or two hands (straight upper and under arm throws, rotational

[80] In actual catching the timing but also the shape within the movement action (MA) must be aligned with the timing and the shape within the motoric movement (MM). That is a far more complex task. See appendix ; The Motoric Movement Action *catching*.
[81] You are able to distil in here that a conscious act to bump into another car, which is the task within for example the bumper cars at a fair, is a more complex task than to avoid a car in normal daily traffic.

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shots, side angled throws, slingshots etc.). However what you normally not will do at all is wondering why the ceiling is lower. That only happens when you don't reset. And you also won't do that if you combine this task with assignment 3. If there is a basketball teammate dribbling with a ball back and forth in front of the basket than you will implicitly wait until the *whole* (!) created perceptual image of the latent ball trajectory shape will become *free*.

d. Conclusion assignments

The assignments in which the grabbing of a mug/glass, with one hand grip to the right side in eight different stances, is the main task clearly shows that every action trajectory contains unique and essential different features. So it is not that we finally grab the mug/glass in a completely different way but the shape over which we move the specific fingertips to the hand grip is always unique. One is able to notice this very easily in the abduction/adduction of the upper arm and the palmair/dorsal flexion of the hand. This becomes more visible if we block the mug/glass with all kinds of objects. By the way there is no claim in here that huge differences occur. The only goal of these assignments is that you start to see that all the differences are as subtle like in the Motoric Movement Action *writing*.
If you are still not convinced than you will have to expand the assignments. Because now the assignment is about one kind of a cup, with a set distance to the *grabber*, at one height in which the mug will be grabbed at one side with the dominant hand. If you are going to vary all of these variables than you probably are able to produce even more action trajectory shapes than we know in writing. Each centimetre difference in height, distance etc. from the *grabber* will lead to a unique different action trajectory shape.
The assignments also show that you don't think about how you execute simple Motoric Movement Actions. If I ask you to grab a mug behind a bag or from the ground than you are mainly occupied with making a success of the specific Motoric Movement Action. During the execution of this action you are occupied with creating a line segment shape out of the perspective of your fingertips and you are not occupied with the question why the mug is not at his usual place. As long as the solutions are simple you will maintain this attitude. Only if the task becomes much more difficult you will start to wonder why you are not able to fulfil this task anymore. And even then your only goal is probably to turn to your cognitive basis to become maximally creative to find an inventive way to create a new action trajectory shape. So even then you are still occupied with the task of getting the mug/glass.

"Visual perception processes are happier with nothing than with something in the action trajectory. So therefore they are actively looking at where nothing is because than the (movement) action object will be able to complete the action trajectory freely. But because there is nothing to be seen in the nothing researchers were not able to see this goal of the perception processes."[82]

What the assignments also show perfectly, and is never noticed, is the fact that the action trajectory is shaped in the *nothing*. In the empty (!) space, the void, *of the animal-environment relationship.* Cognitively we know that the hand needs a completely free line segment shape and not only for example the ending of an action trajectory (*warehouse display window*). Only if the whole line, the whole marble run, is free we will finally will be able to grab something. So in the basketball task you only look at the *whole* (!) available, the functional, *nothing* and not at what is above the lowered ceiling. You just look at what is possible and not what is impossible.
The *nothing* plays a huge role in many Motoric Movement Actions. In the explanatory model that makes the *nothing* much more than just empty, dead, hollow space. The explanatory model finds in here a lot of commonalities with the ecological approach of J.J. Gibson concerning the animal-environment relationship. Gibson observes actions much more out of the relationship between the animal

[82] *Caught In A Line*; p. 42.

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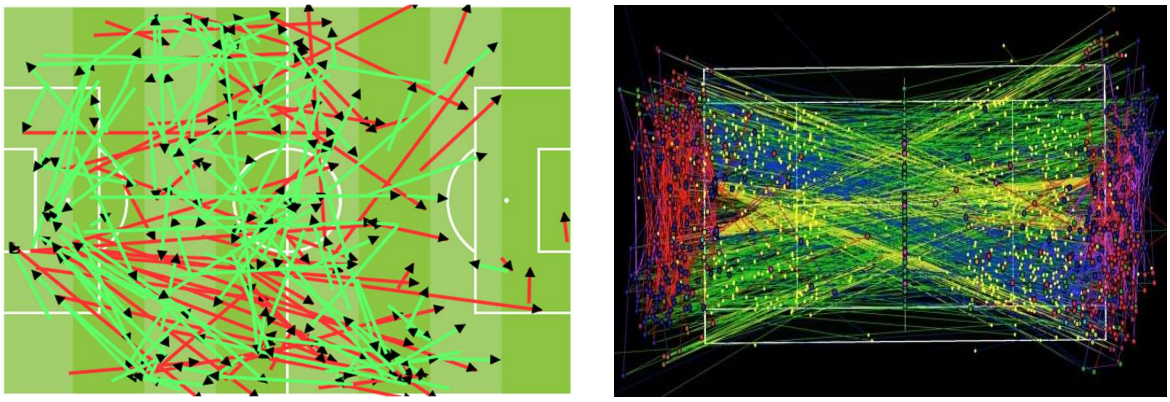
and the (available) environment than primarily out of the perspective of the animal[83]. In there the explanatory model claims as an extra that the dead hollow space is the relation between the animal and its environment. In the explanatory model this relationship is appointed as *the matrix*.



"Image: This is an impression of how a matrix could look like in soccer (left) or in tennis (right). Images of real matrices don't exist yet."[84]

The unrestricted access through the *nothing* is a very important abstract image within our cognitive basis but there is also another abstract image very important in there. That concerns the fact that in many Motoric Movement Actions the (movement) action object first needs to be moved through the *nothing* for a long time and then at the end of the *nothing* the action is over quite abruptly[85]. This abstraction also holds the simple image that we first need to bring two items closer to each other without anything really happening. Like in letter posting or touching a light switch the letter or the fingertip first needs to get closer to the involved items. That doesn't seem to be so important but that explains for example why we start motoric movements (MM), in a safe environment, before we even have created a perceptual image of a latent action trajectory. Because we know that a whole part of *nothing* must be crossed first. These cognitive abstractions also explain why patients like D.F.[86] are able to fulfil all kinds of tasks. Beforehand D.F. isn't able to form an image of the direction of a flexible slit of a (research) mailbox but she does know that a letter first needs to come closer, through *nothing*, to the mailbox. And when you arrive there you still don't need to be able to detect the direction of the slit. When the letter is so close to the slit and you are able to see them both within one visual image you just need to align the direction of the letter with the direction of the slit. That is another abstraction our cognitive basis beholds of this task. Due to years of experience in posting letters we know that a letter doesn't fit into a slit crosswise. So we are able to post a letter by looking at the direction of the slit first and to adjust the letter accordingly. Like we normally execute this task. But it is also possible to post letters alternatively by just aligning two directions in the last phase of the task. This aligning of shapes has nothing to do with the fact if you are able to cognitively appoint the shape.

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[83] "Psychologist James J. Gibson originally introduced the term in his 1977 article "The Theory of Affordances" and explored it more fully in his book *The Ecological Approach to Visual Perception* in 1979. He defined affordances as all "action possibilities" latent in the environment, independent of an individual's ability to recognize them, but always in relation to agents (people or animals) and therefore dependent on their capabilities (https://en.wikipedia.org/wiki/Affordance)."

[84] See: *Caught In A Line*; p. 25; The matrix.

[85] Think about for example the Motoric Movement Action *letter posting* or *switching on the light*. The letter or the fingertip needs to execute a relative long journey through *nothing* and when it approaches, *anything*, the slit of the mailbox or the light switch the action will soon be finished.

[86] The patient D.F. is nowadays well-known due to the fact that her ventral stream is not functioning corrrectly and she still is able to fulfil a letter posting task (https://en.wikipedia.org/wiki/Patient_DF). See also appendix ?; The Motoric Movement Action *letter posting*.

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Once we start realizing that we also look at the *nothing* than we are able to see that for example in road traffic we look at the latent parts of the action trajectories of the other traffic participants and that we use those parts to create our own latent action trajectory *through the nothing*.

If you are still not convinced that a whole action trajectory shape is involved than you have to take into consideration the process that leads to your feet position just before you start the arm action in the mug/glass grabbing task. This feet position must be based on cognitive knowledge concerning the fluctuation limits of the *length* of our arm[87]. Based on this knowledge you take a feet position not too close to the mug/glass and of course not too far away. Like in the Motoric Movement Action *letter posting* is explained the explanatory model assumes that we don't have a lot of considerations in taking that stance. We just take the earliest easy available stance possible, within the fluctuation limits, because we know that the stance is only the prerequisite of this task and that only the actual movement action will actually make the definite action trajectory. That guarantees an effective and efficient way of fulfilling tasks. Especially when you work in a student restaurant hall.
This all together must convince you that it is all about a whole shape of a *marble run* and not only the ending point.

e. Contrasts with current scientific research

At the end of this part I will appoint the contrasts between current scientific research and the explanatory model. It will show where the contrasts are situated and to what standards future scientific research must be raised. And besides that it is an extra clarification of the previous paragraph.
As a starting point I will appoint the contrasts with a research paper from T. Foulsham[88]. This research is exemplary for the way research is executed in daily tasks and how one uses *eye-tracking-gear* in general.

Foulsham publishes the next three photo images in his research paper with the accompanying texts.

- "*The precise location of the fixation on an object also depends on the task and the action being performed. For example, although people tend to saccade straight to the centre of a picture of an object, where they can recognise it most efficiently,11 when planning a reach other object features may be more important (see Figure 1).*"
- *"Figure 1: The view in front of an observer, with his point of gaze (circle) while picking up a mug. He fixates immediately on the handle, about 0.5 s before reaching for the object. Once lifted, gaze moves to a different location."*

Images: If a transparent screen, like in the aforementioned assignment 2 (3rd photo image), would have been placed before this coffee mug than you would have gazed at the hand grip in the exact same way

[87] The length is a very important part of the shape of an action trajectory.
[88] *Eye movements and their functions in everyday tasks*; T. Foulsham.

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like the photo at the left shows. However you would have created a completely different action trajectory shape through the *nothing*. Implicitly you would have created it around the screen out of the perspective of your fingertips. From now on I hope that you will start to see that you visualize a specific action trajectory every time you grab a mug. One might be able to visualize the closing of the gap of the action trajectory ($tau^{G}{}_{MA}$) without a very specific line. However if one wants to maximally concretise that *tau*-value than one first has to create a sound perceptual image of the latent *marble run* between the (movement) action object (the fingertips that will hold the mug) and the hand grip. Then one is able to exactly witness the closing of the gap ($tau^{G}{}_{MA}$) by the (movement) action object by looking at how the manifest part fills the latent part of the action trajectory. This $tau^{G}{}_{MA}$ is coupled to the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$)[89]. The $tau^{G}{}_{MA}$ provides instruction at the right moments to the motoric movement (MM) to adjust the motoric movements according to the closure of the gap of the action trajectory.

Due to the explanatory model one is now able to determine exactly what is happening, concerning the perception processes, when we want to grab a mug. The difference indeed is that the single recognition of an object has nothing to do with the actual Motoric Movement Action *grabbing/taking etc.* of that object. The cognitive recognition of the object happens in a phase before we formulate an egocentric will to do something with the object. So we formulate an egocentric will to drink after we recognized the mug.
The script in the Motoric Movement Action *drinking* is determined by two Motoric Movement Actions. This concerns 1. the action trajectory of the grabbing of the mug and 2. the action trajectory out of the perspective of the rim[90] of the mug that will contact the relevant parts of our mouth. In the photo image on the left you can clearly observe that the first Motoric Movement Action *grabbing* is centred around the whole action trajectory shape with the ending point the hand grip of the mug. At least we are able to see that *eye-tracking-gear* shows gaze at the grip. Of course this ending point is an important reference point for the action trajectory shape but we can also clearly witness in that same photo image that the *eye-tracking-gear* also is confronted with lots of *nothing*[91]. Because of this, and that is clearly noticeable within the photo image in the middle, we are able to shift our gaze to the next Motoric Movement Action when the *grabbing* hand is relatively far from the hand grip. That has a few reasons. 1. It is a *safe* environment. 2. Deviations in the action trajectory decrease exponentially. Especially if one fixates the motoric movement (MM). Fixation of the body in here is obtained by a sitting position[92]. 3. Deviations that even than will occur can be easily covered within the fluctuation possibilities within the motoric movement (MM). The hand grip-hand opening ratio is at least 1:10 or even 1:20. 4. In this script the hand grip can still be observed with peripheral vision.
The shifting of the gaze doesn't mean however that we don't perceive that grabbing anymore. That is not so. The perception processes, and so also the processing processes of the perception, in grabbing only stop if we actually feel the mug into our hand. So until the last moment we create perceptual images of the latent parts of the action trajectory shape in relationship to the actual place of the hand. But, like aforementioned, we don't need direct vision in all environments and that is why we are able to switch to the next script item probably out of efficiency/effectiveness. In this case the next script item first requires the creating of an action trajectory shape out of the transition point of the mug towards the parts of the mouth that will be touched by the mug[93].

[89] For detailed information concerning this *tau*-coupling see appendix D; The Motoric Movement Action *grabbing/taking/touching etc.*.
[90] The transition point within this Motoric Movement Action.
[91] There is only a solid non-transparent screen (the table) below the mug which only limits action trajectories from below the surface of the mug.
[92] In here think about the insertion of a car key from a set position into the ignition switch of the car. In a *strange* car you often need to perceive the ending point (the ignition switch) of the action trajectory of the key with direct vision. In your own car you execute this with a completely internalised action trajectory, due to the set chair position, with no direct vision at all.
[93] In here two remarks are needed. 1. If the mug would be completely filled than we create the same action trajectory but now from the perspective of those parts of the mouth, from the mouth towards the rim, that will make a connection with the rim of the mug to sip some of the fluid first. 2. This is a scientific experiment in which a

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As a closing remark I want to conclude in here that *eye-tracking-gear* is an important new tool but that now you are able to doubt if it is able to show all perception processes. The aforementioned information clearly shows that *eye-tracking-gear* doesn't show crucial, invisible, information and even leads you astray. Not only in the aforementioned research papers but also in scientific research by for example J. Vickers. The Active Eye (TAE) instruction free throw (basketball)[94] clearly shows that elite players check the ball trajectory shape a few times with direct vision just before shooting but when they are actually going to execute the free throw they avoid any actual direct vision with the basket. Then elite players only focus on the initial phase of the ball trajectory shape. But how can you prove that what was very important 0,1 second ago 0,1 second later is absolutely not a part anymore in the rest of the process?
Besides that you have to realize that in a free throw the eyes are close to the starting position of the ball and are just not capable to be in another position than pointing at the basket. And because the player is busy with mainly perceptual images in which he must hold the head as steady as possible it seems like the *eye-tracking-gear*, which shows gaze at the basket, is telling us the truth. But the explanatory model explains that we will seriously have to doubt that conclusion and indicates that we have to break our minds about the future use of *eye-tracking-gear* in order to prove the action trajectory shape.

test subject is only occupied with this task. If you are normally at work you will probably execute the first gaze in the left picture to get a reconfirmation of the position of your mug. But you probably will not execute the second gaze. Especially not with your own special mug. Like the action trajectory in starting your car this action trajectory is internalized in such a way that you don't need direct vision at all. Only if you are going to use a straw for example than you need actual vision to perceive the flexible stance of the transition point of that straw. Although if the straw is relatively fixed, like within a bottle neck, than you are able to easily cover the deviations of all stances of the straw within the fluctuation possibilities of the motoric movement (MM). Then again you won't need direct vision at all.

[94] See: Addendum 1-3; The Active Eye (TAE) instruction *free throw (basketball).*

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Chapter 4 – The motoric movement trajectory (MM) and the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$)

The motoric movement (MM) is not a part of addendum two but I will briefly address it in here. The leading *tau*-value is determined by the movement action ($tau^{G}{}_{MA}$) but the following *tau*-value is determined by the motoric movement ($tau^{G}{}_{MM}$). This happens in all Motoric Movement Actions and these are also the *tau*-values we implicitly experience at the functional, the behavioural, level[95]. In most, simple, (*self-paced*) (!) actions this is not relevant but in complex Motoric Movement Actions like tennis and cricket this is very important.

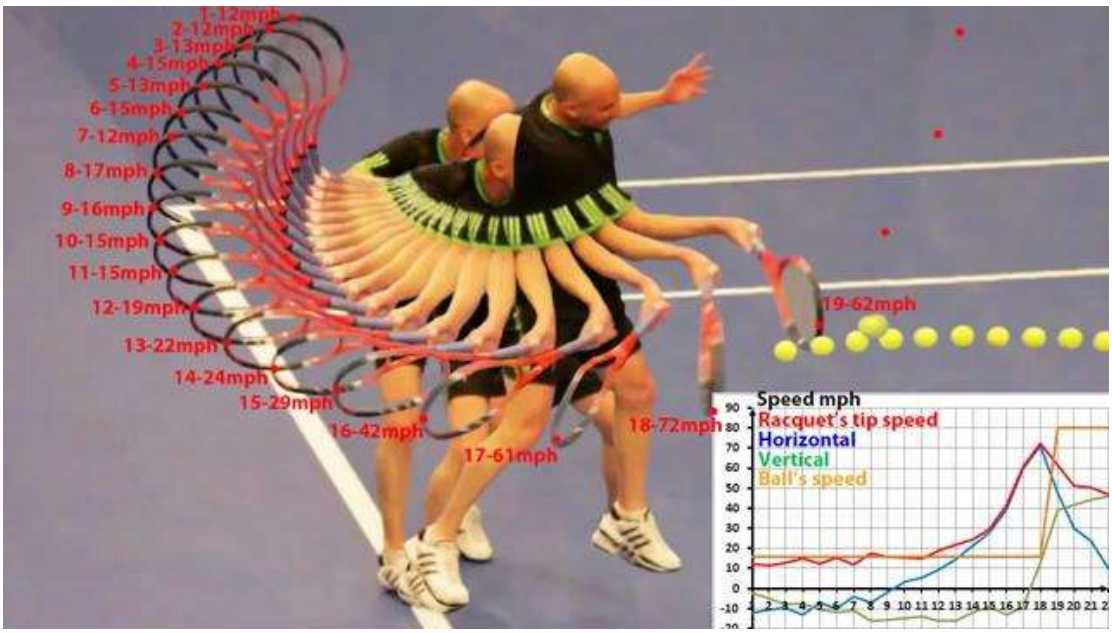

Image: Andre Agassi hits a forehand. Like in almost every game situation he assessed around 3 to 5 tactical choices and chose one option[96]. This encompasses a choice for a unique intersection point of the incoming ball trajectory and the outgoing ball trajectory shape based on cognitive knowledge. Other choices would have led to different intersection points (!) and of course a different incoming and outgoing ball trajectory shape. Agassi based his choice on cognitive knowledge about how the trajectory shapes of 1. the incoming ball and 2. the forehand technique relate in a *precise global* way. During the actual movement action, the Actual Tennis Action[97], he doesn't have to make tactical decisions anymore but he only needs to, actually, link two ball trajectory shapes[98]. Then his visual perception processes are mainly occupied with the catching of the incoming ball and to hit it at the right time and place into the initial phase of the outgoing ball trajectory shape. The visual perception within the movement action (MA) is constantly occupied with the complicated shapes of both ball trajectories and the relevant deviations. Just one simple part within the perceiving of the incoming ball trajectory

[95] Because more *tau*-values and *tau*-couplings are appointed in scientific literature the explanatory model calls this the *functional tau*-coupling.
[96] So this encompasses the tactical department, the cognitive basis and the tactical movement action, to finally come up with a perceptual image of one incoming ball trajectory and one outgoing ball trajectory shape.
[97] See: "Watch The Ball Trajectory!"; Chapter 7.
[98] This is one of the revelations of "Watch The Ball Trajectory!". Tennis is considered to be an open skill sport. But that is true *until* (!) the player made his decision for one very specific outgoing ball trajectory shape. Once a choice is made for one outgoing ball trajectory tennis is not at all open anymore. Then the execution needs very limited and precise technique.

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shape encompasses the time frame in which the ball fills the gap of the latent part of the action trajectory to the intersection point. This provides the leading *tau*-value of the movement action ($tau^{G}{}_{MA}$) and so this *tau*-value is solely observed with direct vision. The motoric movement (MM) is occupied with its own, autonomous, process during these perception processes within the movement action (MA). First Andre Agassi has moved his racket head backwards and now starts with the main phase of his forehand swing. The red numbers 1 to 19 show the movement trajectory of all linked transition points[99]. Between number 18 and 19 the contact point is situated and there the initial phase of the outgoing ball trajectory will occur. Within this task Agassi doesn't need to visually perceive anything and executes his technique in a complete proprioceptive way[100]. His main goal within this task is to align (*shapes* (!)) the shape of the motoric movement (MM), the shape of the technique, with the actual ball trajectory shape which the movement action (MA) will finally offer him. Just one minor/simple part within his technique shape encompasses the time frame in which the sweetspot fills the gap of the latent part of the transition point trajectory towards the intersection point/contact point. This provides the *following tau*-value of the motoric movement ($tau^{G}{}_{MM}$) and so this *tau*-value is mainly observed in a proprioceptive way[101].

So in those sports the leading *tau*-value ($tau^{G}{}_{MA}$) is produced by the incoming ball trajectory shape[102]. We have to observe this gap visually because we don't have any other connection with the ball. During that process, especially in the era of power tennis, we have to make motoric movements (MM) with the goal to first bring the racket head far away from the contact point and subsequently to bring it back to the contact point to transfer a huge amount of energy. That is possible because the Motoric Movement Action contains two autonomous subsystems. The motoric movement (MM) can and must be executed separately.
How the sweetspot is moved is part of a complex tennis technique. The sweetspot will finally hit the ball at the contact point and by doing so it will form the link between the movement action (MA) and the motoric movement (MM). The point where the movement action (MA) and the motoric movement (MM) come together is called the transition point within the explanatory model. In tennis this point is situated between 1. the outside of the strings that will be touched by the ball and 2. the outside of the ball that will be touched by the strings. Before the ball is hit one is able to appoint this transition point out of the perspective of the ball and out of the perspective of the racket head. In this explanation the latter perspective is involved.
If we first take a racket head far away from the contact point and subsequently bring it back to the contact point than all transition points P of the sweetspot also shape a line. A transition point line shape. It has the same character as an action trajectory. Elite players spend years to exactly know where the racket head is situated in that shape and which shape the racket head has at every moment in that line. The difference with the action trajectory however is the fact that elite players don't need to visually perceive this transition point line shape but that they are able to control that shape in a complete proprioceptive way. Always before every stroke elite players also construct a *precise global* image of the

[99] The picture shows a red dot where the racket tip is situated. The transition point isn't situated there. The transition point is situated at the sweetspot of the racket head. Approximately 5-10 centimetres from the tip of the racket. It doesn't make any difference for the involved principle. Both points are *Caught In A Line*.
[100] He invested years of training to gain *proprioceptive* control over that part.
[101] The perceiving of both gaps and the *tau*-coupling is a relatively simple process. Even tennis beginners are able to align these two *tau*-values in the first lesson. That is a simple one-dimensional process. However it will take years before they are able to align the shape of the tennis technique with the shapes the movement action (MA) requires at a certain level. That is a process with multiple, very complex, dimensions.
[102] But notice in here that when I choose a different tactical option with a different intersection point the gap changes automatically into a different line segment.

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latent transition point line shape[103] and so they are also able to observe the filling of a gap with a manifest line shape of the racket head. So this *tau*-value is perceived in a proprioceptive way and will produce the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$). Because we proprioceptively control this *tau*-value we are able to influence this value[104] directly. And because of this we are able to adjust the shape of the technique towards any deviations within the incoming ball trajectory shape. For the *tau*-coupling this means that we are able to closely monitor the deviations within the *tau*-value of the movement action (MA) and to precisely align it with the *tau*-value of the motoric movement (MM).

[103] Just like with the action trajectory the motoric movement (MM) is only able to create a precise perceptual image of a global transition point line shape in the beginning because a completely precise image can't be created yet and isn't necessary at that moment. But the perceptual image must be *precise global* because it will have to provide the fluctuation possibilities to the motoric movement (MM). A completely precise image can only be provided at the end of the actual movement action if hardly any deviations will occur within the fluctuation possibilities of the motoric movement (MM). That precise image will be provided by the processing processes of the perception which have a continuous mutual relationship. So the hitting technique must be narrowed down between very strict borders but will have to be so open that they are able to cover the most occurring deviations easily.

[104] Although it needs to be remarked that that is only possible within narrow fluctuation boarders. A racket head is for example also bound to its trajectory due to inertia.

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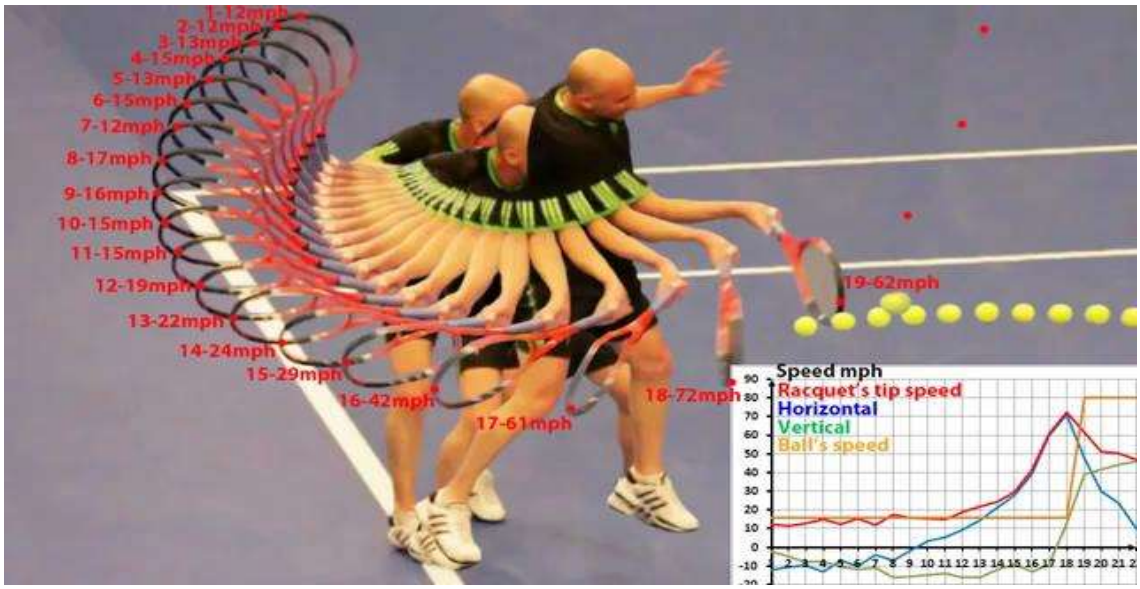
Chapter 5 – The explanatory model versus key concepts within movement sciences

In this section I will review the explanatory model towards key concepts within current scientific research relating to the movement sciences. It contains a mix of 1. a summary, 2. the former conclusions are rephrased in a different form and 3. research possibilities are appointed when suited. Although it is placed before the appendices in this addendum I expect that you have studied most of them, with the aforementioned complex system approach in mind, before you will peruse this paragraph.
As a whole it must have become crystal clear that what current science still considers as one undivided action[105] the explanatory model divides into two autonomous parts. One egocentric formulated task can only be fulfilled by the obligatory cooperation of a movement action (MA) and a motoric movement (MM). Together these simultaneous working complex subsystems form the whole complex system of the Motoric Movement Action. Now the explanatory model appoints all parts involved in there and reveals all processes at a functional level.



I will review the key concepts within current scientific research with this previous used photo image of Andre Agassi. Like aforementioned Andre needs to weigh multiple things tactically in this game situation in a very early phase[106]. He fulfils that task with the help of the *tactical department* of the movement action (MA). The tactical department contains the cognitive basis and the tactical movement action[107]. But I will not spend any time to this decision process and just start reviewing this game situation right after the tactical choice has been finalized. Then Andre only needs to actually execute and finalize the movement action (MA) by actually linking a very specific incoming ball trajectory shape to a very specific outgoing ball trajectory shape[108].

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[105] Probably because it is glued to *one* egocentric formulated task out of *one* egocentric will.
[106] For a complete coverage of what he tactically considers you will have to read "Watch The Ball Trajectory!".
[107] Or more specific in tennis the Tactical *Tennis* Action. For an extensive explanation of this TTA read "Watch The Ball Trajectory!"; chapter 6.
[108] So this is the phase right after the tactical choice for one exact outgoing ball trajectory shape is finalized. In the previous tactical phase the ball trajectory shapes are weighed extensively but if one choice has been made this one choice for one outgoing ball trajectory only needs to be actually executed.
In this way the explanatory model provides a new and final twist to the open versus closed skill debate. For example tennis is considered an open skill sport and free diving a closed skill sport. And that is not correct. If you stand at the top of the ten meter dive tower then free diving is maybe even more *open* than tennis. Then millions of dive trajectory shapes are available. Diving turns into a closed skill only at the moment when you handed a specific dive trajectory shape to the jury. Then you will have to execute that exact shape. And the same can be

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During the actual execution, within the actual movement/*tennis* action (MA), of this forehand Agassi needs to shape two perceptual images of two latent line segment shapes[109]. First he needs to make a *precise global* perceptual image of the incoming ball trajectory shape towards the tactical chosen intersection point of the two ball trajectory shapes. That concerns a latent perceptual image within the movement action (MA). Second he needs to construct a perceptual latent image of a *precise global* trajectory of the whole racket trajectory and especially the main phase of the swing towards the same previous mentioned *precise global* intersection point of the ball trajectory shapes. That concerns a latent perceptual image within the movement (MM) and the movement trajectory in there is created by linking all near future consecutive places P of the sweetspot of the racket head[110].
Both perceptual, *precise global*, images of the movement action (MA) and the motoric movement (MM) will compellingly lead the actual actions. Especially within the last phase of Andre's career (bald head) he trained so many thousands of hours that he is able to meticulously estimate the fluctuation boarders of both line segment shapes. He now knows, at least implicitly, what approaches him and he knows exactly where, how and in what form the ball will be able to deviate and he also knows where, how and in what form the line segment shape of the sweetspot needs to and must answer these deviations of the ball. As an elite player he now is able to optimally answer deviations within the incoming ball trajectory shape with a broad spectrum of fluctuation possibilities within his hitting technique, his movement trajectory shape, and to connect that to an optimal game intention and that is the only thing he can do. Namely *optimizing* (!) this game situation.
But he is only capable to execute that by the means of *comparing* (!) these latent perceptual, near future, images of the ball and the sweetspot with the actual places of the ball and the sweetspot. In principle the perceptual image of the incoming ball trajectory shape is only a *precise global* image. It is an image that arose out of previous successful experiences but that reference image will show unknown deviations in each actual new incoming ball trajectory shape. Ball trajectory shapes will never be identical. However the perceptual image of the latent part of the ball trajectory will become more and more precise when the ball trajectory becomes more manifest. So in the last phase of an incoming ball trajectory the perceptual image of the still latent part will hardly deviate from the actual ball trajectory shape.
Agassi is not able to influence the incoming ball trajectory shape in any way and so this forms the leading/dominant part for him when he actually wants to link it to an outgoing ball trajectory. So within his perception processes he needs to assess the places of the ball because it is an autonomous entity[111]. In this case he fulfils that task by keeping direct vision on the ball trajectory shape. The visual organ is by far the most superior organ to construct a latent perceptual image of a ball trajectory out of a manifest part and to assess occurring deviations.
However like visual disabled persons we are completely capable of executing many actions in pitch black darkness. Then we also determine a perceptual image of a latent action trajectory shape with auditory perception. However in complex actions, and especially combined catch and throw actions like tennis, cricket etc., the auditory perception organ for example is inferior in such a way that actions can't be executed because then the limit of human capabilities is surpassed. The International Tennis

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applied to tennis. When no specific ball trajectory shape is approaching you in one game situation everything indeed is open and one is able to imagine all kinds of ball trajectory shapes. But in the end that also will have to lead to a choice for one specific outgoing ball trajectory shape before one is actually going to execute it. Just like within free diving. So then you will also be forced to execute that one ball trajectory shape.

[109] One must not confuse this phase with the previous tactical phase in which Agassi needs to weigh the incoming line segment shape of the incoming ball trajectory towards the outgoing line segment shape of the outgoing ball trajectory which will have to lead to one intersection point of those two line segments.

[110] The photo image of the forehand of Agassi shows 19 red dots of the racket tip which indicate a big part of the main phase of the swing. However the transition point isn't situated at the tip of the racket head but is situated at one of the sweetspots on the racket head. About 5-10 centimetres form the tip.

[111] Which in essence are the exact same perception processes as in the Motoric Movement Action *catching/not-catching*. See: Appendix B.

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Federation (ITF) also aims at promoting tennis for visually disabled players[112] but examples show that the task within tennis is so complex that that will never be able to lead to full match play.
Andre Agassi is following the leading autonomous process within the movement action (MA) with the perceptual image within his hitting technique which belongs to the motoric movement (MM). He fully monitors this motoric movement (MM) process proprioceptively. No visual perception is involved in there. The *fluctuation boundaries* within his technique are already cognitively adjusted to a universal/opponent-specific average concerning ball trajectory shapes and ball trajectory defining factors[113] (BTDF) and from there he will approach this specific game situation. In there he will be forced to complete a *tau*-coupling which involves on the one side the linking of the incoming ball trajectory shape to the outgoing ball trajectory shape and on the other side the shape of his stroke technique. The shape of this stroke (MM) needs to be aligned to the movement action (MA) in such a way that most of the occurring deviations within the incoming ball trajectory shape can actually be covered successfully[114]. Within the highest levels of tennis the outcome of a match will remain to be decided by the player that achieves the highest consistency rates[115].

In there it is essential to realize that both autonomous processes need to occur simultaneously. It is not possible for Andre to wait until the whole incoming ball trajectory shape is completed first and to observe all the deviations calmly and then start with the motoric movements (MM) of his stroke technique. Then the racket will never arrive in the contact point in time. Even Andre needs to start with the motoric movement (MM) in spite of the fact that the end of the incoming ball trajectory shape can never (!) be perceived in an exact way at that moment. So again and again he needs to prematurely act with his motoric movement (MM) before definite deviations within the incoming ball trajectory shape will become manifest[116]. In a way you are able to say that Agassi is forced to execute such specific motoric movements during the beginning of the movement action (MA) so that it will remain possible that later occurring deviations within the incoming ball trajectory shape can also be covered maximally by other motoric movements (MM). So if a tennis ball skids of the line or a sudden gust of wind

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[112] In this video clip, https://www.youtube.com/watch?v=6z2zv-7b0v4, one can very well observe that the visual disabled player as opposed to Andre Agassi indeed is capable to complete the functional *tau*-coupling without any eye sight/vision. Because that is a relative simple one-dimensional process. He will be able to auditorily perceive the closing of a gap of the incoming ball trajectory to a certain contact point C and to close the gap within the motoric movement (MM) proprioceptively towards the same contact point C. But he will never be able to answer the fluctuation boundaries of the *shape* (!) of an incoming ball trajectory with any specific game intention within an outgoing ball trajectory shape whatsoever. The perceiving of trajectory shapes, especially in fast complex sports, is only restricted to the superior visual perception organ. That must lead to the conclusion that the visual disabled player will never be able to play *the game* of tennis. Just like a lot of not-visual disabled beginning players he will only be able to hit balls.
Although there is an obvious sound when the ball bounces I want to remark in here that the visual disabled player will greatly benefit when the ball itself would produce a continuous sound contrasting to the sound of the bounce. Then he might be able to discover a shape of a ball trajectory and that could ultimately end in the fact that visual disabled players would be able to execute an *agreed* rally with *normal* ball trajectory shapes. But then you really need to focus on hitting the ball in the exact agreed upon shape and in the agreed upon direction towards the opposing partner and that will never have anything to do with *the game* of tennis.
[113] See: "Watch The Ball Trajectory!"; p. 27.
[114] At this point I want to refer to the feet position determination within for example the Motoric Movement Action *letter posting*. A feet position determination is based on extensive cognitive knowledge concerning the fluctuation boundaries of our arm's length within an action trajectory shape. To be able to cover any sudden deviations most people chose a feet position in front of the mail box just around the middle of that arm's length. Agassi is doing the same thing when hitting this forehand. In that way he will be able to maximally cover sudden last moment deviations of ball trajectory shapes which either move towards or away from him.
[115] The game of tennis from the lowest to the highest levels is all about preventing mistakes to happen. At the pro level you also need to be able to hit a certain percentage *winners* but by far the majority of points need to be scored indirectly due to a proper built-up (B) in ball trajectory shapes with the goal that the opponent at a sudden point will not be able to properly answer the fluctuation boundaries of an incoming ball trajectory shape within the fluctuation boundaries within his motoric movement (MM).
[116] In fact this contains the quintessence of the basic idea of the explanatory model. Because of this principle it is a maximal efficient and effective, *parsimonious*, system.

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decelerates the ball tremendously he needs to be trained in such a way that he will be able to adjust the motoric movement (MM) accordingly.

This all leads to the conclusion that within every Motoric Movement Action an optimization process is going on and that an action can never be considered to be an exact equal copy of any of the former ones. Not one forehand in tennis will ever be the same. But also the very simple actions of pressing/touching a light switch or even every single step within the Motoric Movement Action *walking* will ever (!) be executed in an identical way[117]. Again and again occurring deviations within the action trajectory will have to be narrowed down within strict boundaries of the motoric movement (MM). This narrowing down process probably finds its roots in the fact that organisms evolutionary benefit most by executing actions in an efficient and effective, *parsimonious*, way. And that is exactly in line of what you would expect of a historical description within an ecological approach. By quickly shaping *precise global* images and narrowing them down into more *precise* images as soon as possible maximal efficiency and effectiveness can be obtained.

The transition point remains to play a big role within the appointing of key concepts. To gain more practical insight about the transition point it is advised to study the independent appendices concerning basal actions. The transition point determines the specific border between the two autonomous parts of the Motoric Movement Action in which this specific partition point must be seen as the point where the two parts meet or literally transition[118].
The transition point within the forehand of Agassi is finally shaped *between* (!) the outside of the tennis ball that will be touched by the outside of the sweetspot of the racket head and the outside of the sweetspot that will be touched by the outside of the tennis ball when the ball is actually struck. So before the ball is actually struck one is able to approach this transition point out of two perspectives. Out of the perspective of the outside of the ball which is part of the ball trajectory shape within the movement action (MA) and out of the perspective of the outside of the sweetspot of the racket head which is part of the forehand hitting technique within the motoric movement (MM).
How these separate transition points fulfil their separate gaps determine their separate *tau*-values. These *tau*-values finally determine the functional *tau*-coupling.

a. <u>Focus</u>

The novum within the explanatory model revolves around the idea that a Motoric Movement Action always contains two parts in which one part only needs to assess the movements in the *animal-environment* relationship outside the body and that the other part only needs to *execute* this (movement) relationship with movements from within the body. This brings forward that within one Motoric Movement Action specific attention must be payed to different perception processes within the two autonomous parts.
Conform Gibson one needs to pay separate attention to the action *between* the animal and the environment because every Motoric Movement Action will always relate to something in the environment[119].

[117] It is important to understand that not one step will ever be identical to another step in walking but that they will be *equal in shape*. So in walking we don't execute identical but equal shaped steps in which we incorporated an average step as a *reference-step*. This leads to an important new insight. Namely that in a sport like tennis this *equality* of shapes occurs so often that one is able to teach players an *ending* sequence of *reference* ball trajectories within an *ending* sequence of game situations on which actual match play can be based. This forms a big contrast to for example soccer. Besides some independent game situations soccer in general is so much more complex as it comes to the variety of ball trajectory shapes that it will remain to be important to train *reference* ball trajectory shapes but that it can never lead to what one can consider an *ending* sequence of shapes. A soccer player during actual match play needs to remain acting in a much more complex way than a tennis player needs to do.
[118] In each Motoric Movement Action we keep the primary focus on *the whole* of processes outside of our body and simultaneously we keep the secondary focus on the whole of processes inside our body. These two wholes share an intersection point in the transition point.
[119] One of the essences in there concerns the fact that there is *space* (!) between the animal and the environment.

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So the action, also conform Gibson, has nothing to do with the animal itself but with the (movement) action object (MA) which actually will shape that relationship with the environment or with other words will express that relationship within a Motoric Movement Action.
But one also needs to pay attention to the *execution* of the action which conversely needs to be perceived out of the egocentric perspective of the animal/actor because the movement action (MA) is not capable of executing anything. We are only able to perceive the movement of the (movement) action object (MA) within the movement action (MA) and the motoric movement (MM) is only able to execute actions[120].
So no matter how simple a Motoric Movement Action appears to be always two different foci are involved. One focus must always be pointed at the movement action (MA) and another focus must always be pointed at the motoric movement (MM). Although they are both essential within one Motoric Movement Action the explanatory model makes a clear distinction between the two. The primary focus must observe the movement action (MA) because in essence this part fulfils the actual egocentric formulated task and because the motoric movement (MM) serves the movement action (MA). Then accordingly the secondary focus must be pointed the motoric movement (MM). The secondary focus is as essential as the primary focus but is called secondary because it is the *following/trailing* focus. The term primary focus becomes clearer when you study it without the secondary focus. Within the Motoric Movement Action *catching*[121] it is explained extensively that in every environment/vista we mainly don't want to catch (*not-catching*) the vast majority of the present moving items. If we want to reach that goal then we have to assess every, manifest and latent, action trajectory shape of any object or subject in our vicinity concerning their relationship with our position or action trajectory. So within every environment our primary focus is *always* (!) turned on or standing by to just determine any (latent) *foreign* action trajectory shape that might be able to threaten us. The secondary focus only needs to become active if we actually have to avoid/flee from or if we actually want to catch one of those threats. In this way 1. a bridge is constructed between ordinary perception processes and perception processes within a Motoric Movement Action, 2. it fully supports *The Affordances Theory* of J.J. Gibson and 3. besides this a clear entrance is sketched towards the current scientific research concerning *Neuron Mirror Imaging* (NMI).

"*The focus image is being instructed out of the Motoric Movement Action. It is not a free choice. We have to develop thoughts and perceptions when we execute a Motoric Movement Action because there is a compelling task involved. In games/sports we continuously have to develop tactical plans. The perception processes need to check the actual situation constantly but also have to create (near) future images of the (movement) action object continuously. So we must develop a strategy, which we use as a basis for near future places of the (movement) action object and act in the present. That is 100% contradictory to all mental methods that tell you to be without any thoughts or to be in the present. But do you play chess without (future) thoughts or drive your car without thoughts? Do you? In daily traffic you purposely determine your route and you compare your action trajectory with the action trajectory shapes of other participants. With the manifest and with the (near-future) latent parts. Out of the current position and the manifest part of the action trajectory of other traffic participants you sketch the near future places where they probably will be. You look at the "nothing" of their action trajectories and use that as space to manoeuvre. Your motoric movements (MM) in driving a car are probably automatized. However you are still executing the secondary focus towards the transition point subconsciously. You will notice that if you have to use a different car one day. The foot pedals feel strange for*

That is why movements are needed! The *nothing* between the animal and the environment is one of the crucial facts within Gibson's theory as well as within the explanatory model. If the space with *nothing* wouldn't be there then we didn't need to move at all. However it is obvious that we need space to move but the essence of this all is that you need to understand that the space is *providing/affording* (!) movement.

[120] That is why the explanatory model linguistically choose the term Motoric Movement Action. This term can easily be divided in two autonomous parts, the motoric movement (MM) and the movement action (MA), which both show the word movement. It contains the essence of the explanatory model. One part is only able to perceive the movement and the other part is only able to execute that specific movement.

[121] For an extensive explanation see: appendix B.

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a while but you integrate it soon because of your vast knowledge concerning this motoric movement (MM) and because it comprises a very simple technique."[122]

Because mere mortals are not capable of creating two completely separate focus images they combine it to one complex focus image during each Motoric Movement Action. That most likely is the main reason why nobody was ever able to become aware of this[123].
By the way you are able to train yourself to dissect the complex focus image into two separate images[124]. Also gymnasts, dancers, figure skaters, divers etc. will need to learn to separate the involved foci as well. The jury within these sports will not only judge how they arrive from A to B in a set way but also judge the quality of the involved movement trajectories. So a diver needs to feel that during his twists and somersaults that his legs remain close together, that his feet/toes remain pointed etc..
In contrast to these examples in which actors are able to completely focus on the action trajectory the current regime in tennis is situated. The action trajectory, the ball trajectory shape, in tennis has never been explicitly mentioned anywhere as the part that demands the primary focus. In scientific focus research they already came to the conclusion that the more external the focus is positioned the better results are achieved. However that focus remained to be pointed at a body part and therefore remained to be pointed at a movement trajectory within the motoric movement (MM). So what you can conclude is that the focus within nowadys scientific research came closer towards the action trajectory shape but never really came outside of the body and in there the fundamental error is situated. Not any scientific research has ever reached the phase to point the primary focus at the ball trajectory shape. Still the only determining factor within the game idea of tennis remains the place of the ball. Just like the place of the food within the Motoric Movement Action *eating*. However it is understandable why the attention in for example tennis remained focussing on a part of the motoric movement (MM). Tennis technique with an extra flexible (motoric) movement object is an extreme complex phenomenon. But by giving it more and more attention it took us further and further from the solution. By focusing more on the technique you will get more separated from playing the game. Hopefully this will change in the near future.

So current scientific focus research remained far from the explanatory model. First of all they still think that only one focus is involved. In retrospect one can now determine that this one focus didn't go as far outside the body as compared to the primary focus within the explanatory model. Till now the action trajectory has never been noticed and therefore couldn't be appointed as such. As compared to the secondary focus this aforementioned scientific focus often went too far on the outside of the body and was appointed in a much too general way. It wasn't specifically appointed towards the transition point with the action trajectory.
In the future it will become apparent that the primary focus can be appointed in a very *objective/impartial* way but that the secondary focus in sports must be approached much more *subjectively* from within the experience of the athlete. In the future trainers, coaches etc. will need to make an effort to

[122] *Caught In A Line*; p. 30.
[123] Another cause is the fact that the motoric movement (MM) needed in one Motoric Movement Action either was too simple or was too complex to execute. When it was too simple one didn't need to make a perception of the movement trajectory and when it was too complex one wasn't able to create an image of an action trajectory.
[124] In for example the Motoric Movement Action *eating* it is possible to actually focus on the body parts that execute the action trajectory. The secondary focus in there is pointed at the transition point, the bowl of the spoon, towards the action trajectory (the specific line which the food in the bowl constructs). The specific food like the letter in the Motoric Movement Action *letter posting* shapes the action trajectory. The transition point in this *self-paced* action is situated in here between the outside of the food that is touched by the bowl and the outside of the bowl that touches the food. Although the food and the transition point remain close together till the food is *thrown* into the mouth they belong to two totally different entities. The food belongs to the action trajectory shape between the food and the mouth *outside the body*. We are only able to influence the transition point, within the secondary focus, in a proprioceptive way out of specific movement trajectories *within the body*. The eating technique however is so simple that we think we don't pay attention to it but they are part of one complex focus image. So while eating we don't need to pay attention to the eating technique but we will always have the secondary focus pointed on the transition point, towards the primary focus within the action trajectory.

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discover how an athlete personally experiences the motoric movement (MM) and that needs to shape the basic concept how the secondary focus must be actuated/fuelled.

b. The *visuo*-motoric processes

"In humans and other primates, vision provides some of the most important inputs to these representational systems. Such systems are not linked directly to specific motor outputs but are linked instead to cognitive systems subserving memory, semantics, planning, and communication." [125]

The explanatory model will tell us exactly how we have to consider the key term visuo-motoric processes from now on. The formula of the Motoric Movement Action, MMA = MM x (MA), shows that two autonomous processes simultaneously need to be executed for one action to succeed. These are two autonomous processes with each a different perception, a different control etc..
The structure of the explanatory model clearly shows that if visual perception is involved that it belongs to the movement action (MA) and definitely not to the motoric movement (MM). So unlike the sensori-motoric processes which are the subject in the next section one is not allowed to connect any visual activity to any motoric activity because it suggests a direct link between visual perception and motoric output. The essence of the description of the explanatory model encompasses the fact that the perception of an action trajectory shape belongs to an autonomous subsystem that only can be executed (motorically) by a completely different autonomous subsystem. The visual perception belongs to the movement action (MA) and absolutely not to the motoric movement (MM). So there is only an indirect relationship between the two[126].
In that way the explanatory model also provides a complete insight in why and how we are able to execute many Motoric Movement Actions without any direct vision. People are able to execute many Motoric Movement Actions in pitch black darkness. Then they shape a perceptual image of a latent action trajectory shape in a different way[127] because that remains a necessity. So even in pitch black darkness two foci will be needed because without them no *tau*-coupling can be performed and the *functional tau*-coupling is essential within every Motoric Movement Action.
However upfront one can clearly determine that we by far prefer to establish action trajectory shapes with direct vision[128]. The visual organ is by far the most superior[129] perception organ which is able to establish action trajectory shapes. With the visual system we are able to detect even small nuances within action trajectory shapes at large distances[130]. We are not able to do that with any other perception organ[131].

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[125] A. David Milner, Melvyn A. Goodale; School of Psychology University of St Andrews Fife, KY16 9JU Scotland, U.K; http://www.theassc.org/files/assc/2367.pdf
[126] Within current science one will only be able to admit this if one will understand that two foci are involved and that these foci are tied within a strict *tau*-coupling. Only the visually observed *tau* within the movement action (MA) will have its influence on the proprioceptively steered *tau* within the motoric movement (MM).
[127] If we have to open an unfamiliar front door lock with a front door key in pitch black darkness then we first probe the door looking for the key hole with the non-key hand. After we localised the lock we create a perceptual *precise global* image of a latent action trajectory shape between the other hand, the door key hand, and the lock based on this proprioceptive perception and based on that same proprioceptive perception we let the *tau*-value come to zero within the related movement action (MA) when it is executed. It is essential that you start to see that this proprioceptive perception has nothing in common with the proprioceptive perception processes which we use in the motoric movement (MM). The one is namely, with the primary focus, completely pointed at the action trajectory shape on the outside of the body and the other is, with the secondary focus, completely pointed at the movement trajectories within the body.
[128] This again underlines the fact that a optimization process is involved and not one set identical process. Tasks can be fulfilled in different ways but definitely will be optimized if direct vision is involved.
[129] Sensory perception serves many goals. However within the Motoric Movement Action one is able to detect a clear evolutionary path within an ecological approach concerning the *distance* over which one is able to perceive movements in a vista/environment within these sensory perception organs.
[130] So within an ecological approach the visual *experience/sensation* (!) of movement will definitely have created a huge evolutionary step forward because: *'In the land of the blind, the one-eyed man is king!'*.
[131] Within close distances we for example are able to auditorily perceive the location of a nightly mosquito but

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The superior function of the visual perception organ is underlined in the explanatory model and especially in appendix two. It is considered to be the source, the essence, of the earliest ecological evolutionary developments[132]. Conform Gibson it is regarded as the organ that perceives *the connection* (!) between the animal and the environment[133]. Although we don't actually catch a lot in daily life the explanatory model still creates a basal connection with the Motoric Movement Action *catching*[134]. The explanatory model regards this Motoric Movement Action to be always latently present within every vista/environment. Within the whole environment from the earliest times all organisms always want to know if something or somebody approaches their position or action trajectory. In nowadays traffic we also want to know what is moving where and we are also occupied with the (not)-catching of all other participants[135].

In the description of all Motoric Movement Actions it becomes clear that we only observe the action trajectory shape within the movement action (MA) with mainly direct vision. This action trajectory shape is situated between the transition point and the point where the egocentric formulated task will finally be fulfilled. So within catching balls our visual perception is only *functionally* occupied with the ball trajectory shape although we are able to visually perceive the actual last phase of the catching technique. While posting a letter we only need to perceive the trajectory of the letter visually. When we want to grab an apple our visual perception is only occupied with creating an action trajectory shape between the outside of the apple that will be touched by the hand and the outside of the hand that will touch the apple.

c. The *sensori*-motoric processes

The term sensori-motoric processes possesses an ambiguous connotation. That is due to the fact that till now motoric actions have been explained in an ambiguous way. Now with the explanatory model this ambiguity is going to be cleared and it will become possible to define this term in a definite way. In here this key concept will predominantly be discussed in relationship to the processes within the body which we perceive in a proprioceptive way.

If we have to open an unfamiliar front door lock with a front door key in pitch black darkness then we first probe the door looking for the key hole with the non-key hand. After we localised the lock we create a perceptual, precise global, image of a latent action trajectory shape between the other hand[136],

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its exact location often remains a uncertain guess. Also the doppler-effect provides clear indications but in general it remains an ambiguous phenomenon when it comes to creating a *precise global* perceptual image of a latent action trajectory shape.

[132] Before the era of visual perception organisms which were able to perceive movements in other ways around them best would have evolutionary benefited more than other life forms.

[133] However the explanatory model differs with Gibson at one very crucial point. The explanatory model ascribes the perception of movement inherently to the visual organ itself. The explanatory model doesn't think that our visual organ is originally created to interpret single images but says that it originally has been created to experience the sensation of movement because the main goal of the visual organ is to *constantly compare* consecutive static still images in which at first it was not important at all what excatly was in the image. The activeness is situated in the organ itself. It is the same activeness we can find in the auditory perception organ. We are able to perceive sound because our ears make one static still sound image within every time frame and the *active* organ connects them to consecutive images. When it comes to the auditory perception organ we are never interested to interpret one image. So according to the explanatory model an animal doesn't need to move to be able to perceive or to experience the sensation of movement. This ecological approach shows full congruency with the model of the Motoric Movement Action.

[134] See: Appendix B; The Motoric Movement Action *catching*.

[135] See: Addendum 2; Chapter 3.c; The Motoric Movement Action *traffic*.

[136] On purpose I write this down in this way so that it looks correct but in fact is very wrong. Because within such a well-known task we visualize the action trajectory shape in a very specific way out of the tip of key. So not out of the hand and not out of whole key as well, although it all seems to be situated so close to each other. The essence however of this remark is the fact that it is very likely that it doesn't revolve about any specific physical part of the key but that it revolves around the *functional* part of the key.

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the door key hand, and the lock based on this proprioceptive perception and based on that same proprioceptive perception we let the tau-value come to zero within the related movement action (MA) when it is executed. It is essential that you start to see that this proprioceptive perception has nothing in common with the proprioceptive perception processes which we use in the motoric movement (MM). The one is namely, with the primary focus, completely pointed at the action trajectory shape on the outside of the body and the other is, with the secondary focus, completely pointed at the movement trajectories within the body.

In comparison to the visuo-motoric processes the sensori perception processes do belong to the autonomous subsystem of the motoric movement (MM). Within the aforementioned forehand Agassi is visually completely occupied with the ball trajectory shapes within the movement action (MA) but with his proprioceptive perception processes he is completely occupied with filling the gap or with creating the *tau*-value within the specific line segment shape within the unique technique of this forehand with his general forehand technique as a reference basis within the motoric movement (MM). So in this example the visual perception processes must be pointed at the primary focus within the movement action (MA) and the sensori perception processes must be pointed at the secondary focus within the motoric movement (MM) like it happens in all Motoric Movement Actions. Because the perspective of the primary focus is based on the outside of the body and the perspective of the secondary focus is based within the body they can never be merged and/or show any overlap. They are part of two irreconcilable worlds. The motoric movement (MM) must be viewed out of the body of the actor and the movement action (MA) must be viewed out of the relationship *between* (!) the actor and the environment.
As stated earlier tasks can be executed without any direct vision because the visual process doesn't belong to the autonomous subsystem of the motoric movement (MM). However the execution, by the motoric movement (MM), of a movement action (MA) can never be executed without proprioceptive perception processes. A movement trajectory will always have to be created by the body or a part of the body. The secondary focus always needs to be pointed at the biomechanical main action towards the transition point of the action trajectory shape. In daily, *self-paced*, Motoric Movement Actions that is normally such a simple task that we don't become aware of the involved motoric movement technique. Because the required technique is so simple we are able to fully focus on the action trajectory shape and that focus is able to lead the whole action. But although we don't realize this the secondary focus within the motoric movement (MM) is at least always pointed at the transition point. That namely is the last point towards the action trajectory shape out of the perspective of the body which we are able to manipulate and must manipulate[137].
In more complex Motoric Movement Actions, like Agassi's forehand, one can hardly escape the fact that one must become more aware of the secondary focus. Technique within sports which must be executed with the help of an extra flexible (motoric) movement object like a tennis racket, hitting bat, stick etc. is often so complex that one has to focus on relevant movement trajectories within the motoric movement (MM)[138]. Because most of the time many movement trajectories are involved one needs to look for that one feeling or that one compounded movement that can be experienced as the main action within the technique. This appoints the explanatory model as the *biomechanical main action* within the technique. It is very probable that Agassi will experience a *subjective* feeling while executing the motoric movement of his forehand stroke. Conversely to what current scientific research is stating this feeling explicitly needs to stay within the athlete. However what remains for every (elite) player is that this *very subjective* uniqueness must be pointed at the transition point within the specific Motoric Movement Action to a specific shape of an outgoing ball trajectory which always can be observed in a *very objective* way[139].

[137] So within writing you will always focus at the tip of the pen with proprioceptive perception, out of your not-conscious writing technique (MM), towards the action trajectory shape (the writing line/letter). Within eating you will always focus at the bowl of the spoon with proprioceptive perception, out of your not-conscious eating technique (MM), towards the food trajectory shape.
[138] In for example tennis the technique turned out to be so complex that nobody was ever able to appoint the primary focus towards the action/ball trajectory shape.
[139] Also see: "Watch The Ball Trajectory!"; Chapter 10.9; *Ball trajectory shapes do not lie*.

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Till now current scientific research was only able to establish that the proprioceptive perception needs to be linked to two different phenomena within an action. Proprioceptive perception is assumed to have a certain relationship with *limb position* and it is supposed to have a relationship with *movement*. Especially the last term remains a vague phenomenon within there and it becomes very clear that they hardly have any clue about the functional explanation of it all.

"While we have learned a lot in recent years about the peripheral signals responsible for the senses of limb position and movement, the picture continues to evolve. We are beginning to recognize that the source of the signals can change, depending on the task undertaken. Yet we still know relatively little about the central processing of the incoming information. How do we derive the metrics of body parts, for example, or process constantly changing spatial signals during ongoing body movements? This is an area where we should focus future research efforts".[140]

Now science just establishes to appoint accents within *separate* (!) phenomena because an explanatory model is missing. The explanatory model of the Motoric Movement Action now shows clearly that the transition point has a close relationship with the *movement* and shows clearly how this movement is linked to the action trajectory shape. Besides that the explanatory model shows clearly how the *limb position* is linked to the secondary focus and divides that clearly towards simple and complex actions. But maybe the most important issue in there is the fact that the explanatory model shows that the secondary focus must be pointed at the transition point within the motoric movement (MM) towards the action trajectory shape. Due to this explanation the relationships between the different kinds of proprioceptive perception processes within the motoric movement (MM) become fully comprehensible[141].

Again the explanatory model doesn't really reject a lot within this scientific research as well but again it adds an explanation and by doing so it adds the last piece of the puzzle. So it confirms most of the observed accents within scientific research and adds a strict framework in which all the phenomena get their distinct places. As aforementioned the observed phenomena of the *movement/limb position* will be kept completely within the motoric movement (MM). However the explanatory model notices another novum within the proprioceptive perception.
If we have to open an unfamiliar front door lock with a front door key in pitch black darkness then we often first probe the door looking for the key hole with the non-key hand. After we localised the lock we create a perceptual, precise global, image of a latent action trajectory shape between the other hand[142], the door key hand, and the lock based on this proprioceptive perception and based on that same proprioceptive perception we let the tau-value come to zero within the related movement action (MA) when it is executed. It is essential that you start to see that this proprioceptive perception has nothing in common with the proprioceptive perception processes which we use in the motoric movement (MM). The one is namely, with the primary focus, completely pointed at the action trajectory shape on the outside of the body and the other is, with the secondary focus, completely pointed at the movement trajectories within the body.
With this example the explanatory model clearly shows that we are able to create action trajectory shapes within the movement action (MA) solely based on proprioceptive perception processes. It also shows that we are able to follow the progression of the shape and the *tau*-value of the action trajectory

[140] U. Proske & S. Gandevia; http://www.the-scientist.com/?articles.view/articleNo/46796/title/Proprioception--The-Sense-Within/
[141] The proprioceptive perception of the *limb position* has a set relationship with the proprioceptive perception of the *movement* within the secondary focus.
[142] On purpose I write it down in this way but it is not correct. Because within such a well-known task we visualize the action trajectory shape in a very specific way out of the tip of key. So not out of the hand and not out of whole key as well, although it all seems to be situated so close to each other. The essence however of this remark is the fact that it is very likely that this phenomenon doesn't revolve around any specific physical part of the key but that it revolves around the *functional* part of the key.

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solely with proprioceptive perception in the same way visual perception is processed by the dorsal and ventral stream. So it is possible to link the proprioceptive perception to many essentially different phenomena within one Motoric Movement Action.

d. Vector coding, position coding, parameters, coordinates etc.

"This elegant, yet parsimonious solution, suggests that there is no need for the brain to compute current distance, velocity or acceleration; instead the information needed to time our actions is directly available through the way the gap changes over time."[143]

Another novum that arrives with the explanatory model of the Motoric Movement Action is the fact that action trajectories within the movement action (MA) as well as movement trajectories within the motoric movement (MM) are caught in specific line segment shapes or are *Caught In A Line*[144]. The action trajectory and the movement trajectory within every Motoric Movement Action are, conform the classic marble run, such specific line segment shapes that beforehand one is able to make (*precise global*) statements about them. That is an important line of thought. Although the explanatory model provides a much more complex explanation of a whole Motoric Movement Action as compared to current scientific explanations[145] (science will have to catch up with that fact) the aforementioned linearity however will have the big consequence that earlier much more complex scientific explanations within parts of the action can be explained a lot simpler[146].
Without linear line shapes, in which each place P(0) has a definite relationship with each place P(+1) and P(-1), nowadays scientists, logically, seek their refuge in much more complex explanations which in general suggest that actors experience Motoric Movement Actions out of much more complex egocentric vector/position codes, parameters, coordinates etc.[147]. Within this phenomenon scientists introduce many various, too complex, explanations concerning these parameters etc. and the multiplicity implies that current scientific research is still looking for the right explanation. In which the explanatory model remarks that they will never find such an explanation because it shows that it is all a lot simpler[148]. One can say that current science assesses this phenomenon as a (separate) *points* issue as compared to the explanatory model which assesses this phenomenon as a (*connected* points) *line seg-*

[143] Cathy Craig; Understanding perception and action in sport: How can virtual reality technology help?
[144] The gap is already noted by Lee et al. but remains a complete *black*/abstract phenomenon in his *tau*-theory. Conversely the explanatory model exactly specifies that part in an ending way and by doing so it even more emphasises the mentioned quotation.
Also see: Appendix A; *The ball trajectory shape*.
[145] Explanations like for example The Quiet Eye (TQE) will in retrospect be considered as naïve *linear* approaches. See also: Addendum 1.
[146] In "Watch The Ball Trajectory!" I also show that the current scientific research concerning *relative phase* has no relationship whatsoever with the game idea in tennis. The *relative phase* research is maybe a promising mathematical phenomenon in gaining insight in complex systems but for explaining the game idea it is much too complex.
[147] One can say that current science assesses this phenomenon as a (separate) *points* issue as compared to the explanatory model which assesses this phenomenon as a *line segments* issue. If one observes a movement as just combined, *random*, separate points it is easy to determine that this phenomenon gets a much more complex character.
[148] The explanatory model even indicates that the origin, the essence, of our visual perception organ is originally created to experience movement in line segments or to experience zero-movement in zero-line segments. Contradictory to Gibson the explanatory model implies that the visual perception organ is an implicit active organ in which (somewhere!?) static still images of all points P within a vista/environment are compared *continuously* (!). Just like a flip book. This can only occur because the visual perception organ, like the auditory perception organ, continuously provide static still images in which the primary goal, the *comparing*, is embedded. So in this way the earliest organisms will just have experienced the sensation of movement. Later organisms gained the ability to combine those separate moving sensation-*points* (!) to line segments due to the perceptual organisation.

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ments issue. If one observes a movement as just combined, *random*, separate points it is easy to determine that this phenomenon gets a much more complex character. Then the complexity will increase with a factor with each added random point within a line segment shape and *functionally* that is infeasible.
Although the explanatory model most of the time confirms the discovered phenomena within other scientific research and only adds a final step it must become clear that this subjacent scientific research is completely denying line segment shapes and therefore, like the *relative phase* research, must be fully rejected.
Therefor I will not review this current scientific research any further. The explanatory model shows that we don't need anything of egocentric vectors, parameters, coordinates etc. at all because Motoric Movement Actions are experienced in fixed line shapes. We just create line segment shapes out of the body. Within most simple Motoric Movement Actions the action trajectory shape is sufficient enough to guide its associated simple technique[149]. The simple (action trajectory) line (shape) of the food in the Motoric Movement Action *eating* makes it obsolete to even consider the feeding or throwing technique[150].

From an ecological perspective this simplification can be maintained many times more than an explanation in which actors are obliged to own a certain brain capacity which must be capable of executing various complex calculations of parameters, coordinates etc. and in that way forms a much better explanation for the development of the earliest organisms. Besides this it is easy for you to empirically experience that you don't calculate anything at the functional level. You can experience this right away by actually executing the Motoric Movement Actions mentioned in the appendices.

e. <u>*Tau*-theory, *tau*-values and *tau*-coupling</u>

Another novum that arrives with the explanatory model of the Motoric Movement Action is the fact that action trajectories within the movement action (MA) as well as movement trajectories within the motoric movement (MM) are caught in specific line segment shapes or are *Caught In A Line*[151]. The action trajectory and the movement trajectory within every Motoric Movement Action are, conform the classic marble run, such specific line segment shapes that beforehand one is able to make (*precise global*) statements about them. That is an important line of thought. Although the explanatory model provides a much more complex explanation of a whole Motoric Movement Action as compared to current scientific explanations[152] (science will have to catch up with that fact) the aforementioned linearity however will have the big consequence that earlier much more complex scientific explanations within parts of the action can be explained a lot simpler[153]. Although the explanatory model of the Mo-

[149] You really are not aware of the complex motoric movement process involved within eating. And at a functional level you pertinently don't need to pay any attention to this process. By just observing the action trajectory shape of the food you implicitly give feedback to the motoric movement (MM). Within tennis however just a few elite players find this essential approach. The ball trajectory shape has never been appointed explicitly in any tennis method. Most tennis players only emphasize the hitting technique and therefore will never reach the state of *flow*. Or maybe worse will get more segregated from experiencing the game in ball trajectory shapes.
[150] In essence all Motoric Movement Actions can be reduced to two categories. They are either catch or throw actions. Within catching there is what we vernacularly call *timing* involved. We are not able to execute these actions within our own tempo. Within all other (throwing) actions there is *self-paced* timing involved. We also *throw* the letter or the food in the beginning of a line segment shape and we are able to continuously adjust this shape by holding the letter or the food.
[151] See: Appendix A; *The ball trajectory shape*. In this appendix the contradictions within using a Z-ball versus a tennis ball clearly display the nuances and the borders within our perception processes when it comes to the ball trajectory shape and the *tau*-value of the movement action (MA).
[152] Explanations like for example The Quiet Eye (TQE) will in retrospect be considered as naïve *linear* approaches. See also: Addendum 1 in which The Quiet Eye (TQE) is opposed to The Active Eye (TAE) and in which especially the manifestation of the explanatory model is assessed.
[153] In "Watch The Ball Trajectory!" I also show that the current scientific research concerning *relative phase* has

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toric Movement Action remains an explanation and doesn't provide any scientific evidence the explanation concerning the *tau*-values and the *functional tau*-coupling is in my view so convincing that it is much more than just an explanation. And that is also due to its simplicity. In the *tau*-coupling the whole manifestation of the explanatory model and its functioning is interlinked. All key issues within current scientific research have to be regarded in a specific binding way in which new insights gained in one part will force you to accept it in other parts as well. For example a *tau*-value can only be created if you first make an end to the action-perception dichotomy. Because a *tau*-value within the *functional tau*-coupling can only be created by the obligatory cooperation of a perceptual latent image of a line segment of the whole action trajectory shape and an actual image of the manifest shape of that action trajectory. The closing of the gap can be experienced by observing how the latent part of the action trajectory shape disappears[154]. The photo images of tennis situations which are used to introduce the *tau*-coupling in this addendum perfectly show how these *tau*-values must be observed and that they can be recognized and assessed within one's own empirical experiences immediately. Like many aforementioned aspects of the explanatory model they are fully congruent, coherent etc. with many aspects within current scientific research. Most of the time the explanatory model also doesn't really contravene with those aspects but conversely also like with the *tau*-theory it takes one extra, *crucial*, step further and fits in the last piece of the puzzle.

"*The second point concerns the connection between the hand and the object. When watching a fielder catching a ball one can get the impression that the ball is physically connected to the hand, even before the catch is made. It is as if hand and ball are connected by invisible elastic that draws them together. There is, in fact, a physical connection between the hand and the ball before contact is made. It is not, of course, a material connection like a piece of elastic. Rather it is an informational connection, more like that between an operator and a radio-controlled model plane."*[155]

So with these new insights the, *functional*, *tau*-theory can be finalized now. Although one in retrospect will be able to determine that Lee's research provided already many essential aspects and thoughts and came close to the truth one is also able to see that it was a too complex explanation within parts and all in all never could have led to the explanatory model of the Motoric Movement Action. For example the *tau*-value, the gap, within an incoming ball trajectory shape has never been noticed by Lee[156]. By the way within the whole current science the action is only explained out of an egocentric perspective in which there is no room for an autonomous part describing the relationship *between* (!) the actor and the environment.
Besides this Lee's insights that *couplings of two or more parts* take place should have led to the insight that more foci could possibly be involved in a Motoric Movement Action and that could have led to the external appearance of the explanatory model with its two autonomous parts and its implicit *tau*-coupling. But obviously it never came that far.

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no relationship whatsoever with the Game Idea in tennis. The *relative phase* research is maybe a promising mathematical phenomenon in gaining insight in complex systems but for explaining the Game Idea it is much too complex.

[154] The whole latent marble run shape of a classic marble run shapes the perceptual image. When the marble starts to move it will reveal a manifest actual marble run shape within there. In that process the latent part, the gap, will disappear more and more and finally approach zero. It is crucial that you start to understand that for the *tau*-value the only thing important is the filling of the *line* segment (shape). That is a one-dimensional, simple, task. However the marble within a marble run also fills a specific (line segment) *shape*. To be able to understand that a ball creates its own specific ball trajectory shape but also is bound to an exact, *precise global*, shape is a much more complex task which for example tennis or cricket players need to practice for years. Then you need to be able to visualize the exact, *precise global*, shape in empty space before you as like within the situation when a physical marble run is actually in front of you.

[155] David N. Lee; *Tau in Action in Development*; p. 4.

[156] And so no one was able to create an overlap with the essential basal Motoric Movement Action *catching*. And due to that no one was ever able to create an overlap with J.J. Gibson concerning the animal-environment relationship.

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Therefore I will not further comment on D.N. Lee. I will only appoint how the explanatory model defines the *functional tau*-theory.

1. *Tau*-values [157]

Now with the explanatory model the *tau*-values can be defined in a very precise way. The *gap*, distilled from "*Mind the gap!*" (subway), remains important. However the explanatory model provides within every Motoric Movement Action very specifically from which perspective a line segment shape of that *gap* must be determined. So the explanatory model gives a much more concrete meaning to the abstract, *black hole* of the, gap. It not only describes that there is a concrete simple line involved but even goes much further by explaining that this line is part of a much more complex *shape* (!).
Within this phenomenon we are able to determine that the constructing of gaps is inherent to the functioning of our visual perception organ itself. Our visual perception organ namely creates still static images[158] every time frame in which must be emphasized that the *comparison* of these consecutive images either show movement or zero-movement. In that way all moving objects with their specific *consecutive* places P, Q, R, S, T etc. will always be linked in a *linear* way. In which one can define a manifest and a latent part of a line segment shape as long as the movement continues. This explanation can be maintained within an ecological approach for even the simplest and earliest organisms and so complies fully to the demands within that approach. Within the earliest organisms only the *sensation* of movement, even before the phases of perceptual organisation and later cognitive enhancements, could have led to an evolutionary advantage. For the *sensation* of movement one doesn't need to be able to cognitively appoint what or how something moves or has to be aware if the moving object creates a specific line shape. To experience the sensation of movement an organism only needs to remark that an ob-/subject shows a *difference* (!) in places P. So even before the phase of perceptual organisation in which a specific line segment is shaped out of these places P the sensation of movement can be experienced.

"3.1 Action-gap
An action-gap is defined, in general, to be the changing gap between two measurable states. For example, the changing gap between the measurable state an animal is currently in and the goal state that it wants to be in is an action-gap. All purposeful actions entail controlling the closure of action-gaps, often in tandem. For instance, stepping forward to pick a fruit from a tree requires controlling the closure of the angular action-gap between the current gaze direction and the direction of the fruit in order to adequately visually control the reach; the force action-gap between the current force exerted through the foot on the ground and the force required to satisfactorily step forward; and the distance action-gap between the hand and the fruit in order to grasp the fruit."[159]

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[157] In this section mainly the constructing of the *tau*-value within the movement action ($tau^{G}{}_{MA}$) is reviewed because it relates to the most innovating part of the Motoric Movement Action. The determination of the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$) mainly follows this description. The crucial difference however is the fact that the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$) is perceived in an exclusive *proprioceptive* way.
[158] Conform Gibson the explanatory model accepts that visual perception is a direct occurrence. However that doesn't take away that at any moment t(x) somewhere, somehow a direct translation of the visual stimuli to one static still image need to occur. In which the explanatory model clarifies that, different to Gibson's view, that one static still image at a random moment t(x) within an ecological idea is totally irrelevant but that *the comparison of the consecutive images* conversely encompasses the crucial insight. Just like a flipbook (see: *Caught In A Line*; p. 12). Namely then we will be capable to perceive everything in the environment as movement or a 0-movement and that is what the explanatory model defines as the essence of the evolution of all organisms in relationship to the existence of the visual perception organ. The perceiving of (zero-)movements is implicitly woven into the, *still standing* (!), visual perception organ. So we perceive an apple, lying still, in a fruit basket as active as the apple that falls from a tree.
[159] *How movement is guided*; David N. Lee; p. 5/6. If you compare the second part of this quote with the explanatory model you are able to notice the enormous difference in complexity of all the *tau*-couplings. In actions Lee couples many complex *tau*-values in very many ways. The explanatory model holds a much simpler explanation and remains a universal explanation in every action.

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If we don't possess any cognitive knowledge about the movement behaviour of a specific object X yet then, *intelligent*, people are still able to construct a latent line shape segment out of the manifest part due to perceptual organisation and general cognitive knowledge. Most moving objects will comply to set physical laws which simply can be comprehended at the functional level and that makes that we are able to construct a perceptual image of a *precise global* shape of the latent part of the object trajectory X out of the manifest part. Because we were also able to construct a value of the separate specific time frame in how this object X closed the gap within the manifest line shape during that process we are also able to construct a perceptual *precise global tau*-value of how the latent part will be closed in time. In a set classic marble run in which the latent shape can be predicted in a *precise* way this *tau*-value can only be determined in a *precise global* way[160].
So with every moving ob-/subject in every environment we create a perceptual image of the latent line segment shape in which it is embedded (*caught*/*trapped*) and we create a *time image* of how fast that line shape will be filled. If we consider an end point of that line segment, for example a contact point (tennis, cricket etc.) or a catching point, then a specific ending line segment will occur in which the latent part within the perception gradually, *linearly,* disappears. Or with other words the *tau*-value within the movement action (MA) will approach zero at that end point. That is the main reason why we are able to catch (or at least block, avoid or not-catch) *normal* moving ob-/subjects in a very basal way from the first year of our life[161].
Although in there one needs to make the next essential distinction. If one inflates a balloon and let it go without tying it up or let a Z-ball bounce then a human being indeed is somehow able to create a *precise global* image of how an eventual occurring line shape will be filled in terms of the involved time frame but one will never be able to create a *precise global* image of the shape of the whole latent object trajectory[162]. Mere mortals will never be able to translate that object behaviour in a *precise global* latent perceptual image out of the first initial phase of the object trajectory. So a big distinction needs to be made between just the perception of the filling of a gap within a (just any) *line* (-segment) and the perceiving of the exact, *precise global*, (line segment-) *shape* where that line is a part of.

The filling of just a line segment is for human beings a very simple one-dimensional task and the explanatory model appoints this as the *tau*-value. In that way even absolute beginners[163] in tennis are able to answer the disappearing of a gap within the incoming ball trajectory shape (the *line* within the *shape*) to a certain contact point with a disappearing gap within a certain, *haphazard*[164], hitting technique within just one lesson. Every beginner will be able to just hit tennis balls within an hour due to

[160] The time frame in which an (movement) action object fills the action trajectory is also a part of the *shape* of that object trajectory. So a marble in a set classic marble run will not be able to deviate a lot in the width of the trajectory but at any point P of the action trajectory it is able to deviate in time in the *length* of the shape. Like every ball will be able to deviate in time. That is also the crucial reason why we still need actual (bottom-up) perception processes if we want to intercept the marble at a specific point and that exactly forms the basis of why the Motoric Movement Action *cat and mouse game* is so hard to execute although the action trajectory in there possesses a *precise* marble run shape.
If we further assess the *shape* in relationship to the length then it is essential for you to see that in tennis there is actually not any demand as it comes down to the length of ball trajectories. In tennis only the shape of the ball trajectory *before* the second bounce in relationship to the opponent is important. After that the ball trajectory is allowed to shape unlimited distances. That is different in golf. In golf putting there is a set demand concerning the length of the (pen-)ultimate ball trajectory shape. See for an extensive description: The motoric learning instruction (TAE) within golf putting in addendum 1.
[161] See: Appendix B; The Motoric Movement Action *catching*.
[162] So the precise global *tau*-value can't be coupled to a specific *length*-shape and that means that we are not able to do a lot with it at a functional level because we are not able to foresee *where* (!) that *tau*-value will become relevant. For extensive information see: Appendix A; *The ball trajectory shape.*
[163] Even toddlers are able to perceive these gaps, https://www.youtube.com/watch?v=LJWAempVhOg, and to successfully execute the functional *tau*-coupling. However for years it will remain to be just hitting balls which has nothing to do with playing the game of tennis.
[164] Within the first tennis lesson the hitting technique will have hardly any relationship with what the game de-

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this one-dimensional *tau*-coupling but that has nothing to do with the playing of the very complex game of tennis at an elite level. At that level one needs to link a specific incoming ball trajectory shape to a specific outgoing ball trajectory shape with an optimal game intention by means of an optimal shape within the motoric movement (MM) or the hitting technique. If you want to be able to do that you need to have developed a huge cognitive basis of all relevant shapes due to many years of very intensive training.

Like aforementioned a *tau*-value can only be created by the mandatory cooperation of 1. the creation of a perceptual image of the whole latent line shape and 2. the observing of the actual filling of that line segment shape by the (movement) action object with direct, most of the time visual, perception. This explanation shows a much more concrete view than the view expressed in Lee's *tau*-theory. The measurable state of a gap between 1. the state an animal is currently in and 2. the goal state it wants to be in remains a vague description of the reality. The explanatory model makes a definite end to any vagueness by fully appointing, the *marble run* present in, that gap. And by telling exactly what is happening within that gap it also ends the perception-action dichotomy in which the explanatory model, conversely to what one might think, fully acknowledges and explains most of the found scientific results within both sides within that dichotomy. The "*perceptionists*" were partly right because indeed an action can't be executed without a latent perceptual image but erroneously kept on alleging that this image needs to contain all essential information from the beginning[165]. Conversely they should have had admitted that an ecological, efficient and effective (*parsimonious*), developed organism utilizes an optimization process in which at first a latent perceptual image is obligatory but only needs to provide a *precise global* image of what is happening during the initial phase and gradually work towards a more and more precise image when the action reaches its climax. The "*actionists*" were partly right as well because an action needs obligatory information of direct perception within the actual action. An action can be executed and is executed only due to direct perception, direct bottom-up perception processes, because indeed as they stated our cognitive basis isn't able to possess and assess all actual action trajectory shapes beforehand. However within that view they should have had acknowledged the fact that a *precise global* leading (*helping*) image is needed to roughly guide the actual perception processes. Without that *precise global* image one can hardly brainstorm about the possible consequences because we just always create it but without that image it would probably have led to the fact that at the actual moment too many complex things need to be perceived and processed at once[166].
And of course they both were wrong because they couldn't see that they are both crucially needed in creating a *tau*-value and that they themselves just were (simple) parts of a bigger complex process and so never have been the sole responsible phenomenon within a Motoric Movement Action.

So with the explanatory model one is able to formulate a crucial necessity for the *tau*-value to occur. Namely that there need to be movements which we are able to perceive in line segments. Only then we are able to determine a *tau*-value and are we indeed able to actually couple these *tau*-values at a functional level[167].

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mands at the professional level. The hitting technique then will definitely show more overlaps with the basal *hitting/blocking* as we were used to do when a dangerous animal threatened us physically.

[165] Conversely the explanatory model shows that nobody (!), never (!), will be capable of visualizing the precise shape of an incoming ball trajectory. Only when the ball will occupy the last actual place P of a ball trajectory then we can be certain about the whole shape. Before that point every ball will and shall deviate at any place P.

[166] For example without a *precise global* latent perceptual image of an incoming action trajectory shape one isn't able to create an intersection point within the tactical movement action (MA) beforehand with a latent outgoing ball trajectory shape in for example tennis. And without that *precise global* intersection point one isn't able to create a *precise global* latent perceptual image of a gap, and an associated *tau*-value, within the motoric movement (MM) of the sweetspot of the racket head from a random point x to that same intersection point. So without *precise global* perceptual images all those conclusions can only be drawn at the moment that the ball actually will have filled the whole ball trajectory shape and so you will not be capable of planning anything which in essence makes it impossible to develop any tactical plan.

[167] This shows the exact difference between the Motoric *Movement* (!) Action (MMA) and the Motoric Action (MA). The Motoric Action, for example standing still, is only occupied with non-movements or zero-move-

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Accordingly it is very obvious that we are able to explain the Motoric Movement Action *blowing*[168] with the explanatory model. There is a clear action trajectory shape involved. The egocentric formulated will, within this obvious *throwing* action, is namely pointed at the shape of the airflow *between* (!) the exit of the mouth and in many occasions the candles on a birthday cake outside of the body. The motoric movement (MM), the blowing technique, within the body must be pointed at the transition point towards the action trajectory shape. In this case it must be pointed at the specific mouth opening which goes along with blowing.
In that way one could also accommodate singing/talking etc. within the explanatory model of the Motoric Movement Action. The phenomenon of stuttering could then be explained perfectly as well as the cure to overcome stuttering. However the explanatory model signals that a definite border is approached in here which certainly needs more scientific attention because like within playing the piano[169] the Motoric Movement Action *talking/singing* is not occupied with the *spreading* of the sound but only at the *producing* of the sound. The sound is spreading after it is produced. So after the Motoric Movement Action is completed.

2. The *functional tau*-coupling

Within current science many *tau*-values are being appointed. Lee also appoints many *tau*-values and couples them in many various ways. The explanatory model however notices that too many random links are being appointed in relationship to a Motoric Movement Action and conversely appoints what exactly needs to be coupled and exactly where it should be coupled at the functional level. Because there is always a specific transition point involved from where the secondary focus within a complex focus image simultaneously needs to be pointed at the primary focus.
Within the *tau*-coupling always two *tau*-values are involved ("*often in tandem*"). A *tau*-value connected to the motoric movement ($tau^{G}{}_{MM}$) and a *tau*-value connected to the movement action ($tau^{G}{}_{MA}$). The latter is always the leading *tau*-value and must always be aligned by the other *tau*-value ($tau^{G}{}_{MM}$). They both belong to specific line segment shapes in which the gap gradually disappears or in other words in which the *tau*-value in the end becomes zero.
From this information you are able to deduce that all Motoric Movement Actions are in fact *optimization* processes and definitely do not contain *set*, always synchronized working, processes. You will not be able to close these, to two worlds belonging, gaps in an equal synchronized way ever. First a ball will not be able to comply to an imposed ball trajectory shape in the exact same way[170] ever and second you also will not be able to ever execute a motoric movement (MM) identical to another one. By

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ments. In the Motoric Action ((MA) no *tau*-value can be distinguished. The Motoric Action is extensively appointed in *Caught In A Line* (p. 48 a.f.)

[168] See: The Motoric Movement Action *blowing/talking*; *Caught In A Line*; p. 82.

[169] The script within the Motoric Movement Action playing the piano consists of the Motoric Movement Action touching directly linked to the Motoric Movement Action pressing (throwing).
When I will have finished this addendum I will soon produce a description of the Motoric Movement Action *billiard sports (snooker*). During the writing of this addendum I namely came to the understanding that the *tau*-coupling within just the single touching (!) of for example a golf ball with a putter, just the approach to the very outside of the golf ball within a complete Motoric Movement Action *golf putting*, can't have a direct set relationship to what happens *after* (!) that, first, initial touching of the golf ball. In that same way the cueing of a billiard ball also contains *two linked* (!) Motoric Movement Actions with each a separate autonomous *tau*-coupling. These are the Motoric Movement Actions *touching* and *throwing*. So in a script they always need to be linked. Therefore the *tau*-values within the touching will never be able to have a set relationship with the *tau*-values of what happens after that touching, the throwing, of a ball. This shapes a crucial contradiction to what for example Lee and Craig suggest (See for example: *Guiding the swing in golf putting*; Craig et al.). In the same way the closing of the gap towards a piano key within the Motoric Movement Action *touching* will never have a set direct relationship with the pressing, the *throwing*, of that piano key. The Motoric Movement Action *billiard sports (snooker*) will exactly show which complex subsystems are involved and how that leads to just a *correlation* between the *tau*-values of the touching and the throwing.

[170] Recently I have been confronted with scientific research concerning Bayesian Decision Theory. For example: http://cbl.eng.cam.ac.uk/pub/Public/Wolpert/Publications/KorWol_TICS_06.pdf . The main fallacy within that research concerns the fact that this research expects that the completely autonomous entity *ball* will exactly follow the during the initial phase imposed whole shape. But that is an *idee fixe.* The ball can and will deviate at

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the way you are able to verify these facts at this very moment within your own empirical experiences. So one always will have to *try* (!) to align the disappearing gap within the movement action (MA) with the disappearing gap within the motoric movement (MM) *as sound as possible* over and over again and that is the maximum a human being can try to aspire within a Motoric Movement Action. Optimization is the highest achievable goal in every Motoric Movement Action.

f. The processing processes of the perception – The ventral and dorsal stream

As the final key concept I will now depict the explanatory model against the processing processes of the perception. The explanatory model of the Motoric Movement Action regards them particularly operative during the actual movement action within the separate complex subsystem of the movement action (MA). In the beginning of addendum two it is explained that we construct most action trajectory shapes conform a marble run but mainly without a physical marble run present. The big advantage of that *free* marble run is the fact that one isn't bound to one exact shape of an action trajectory and so that makes it possible to improvise maximally. But that has a price as well. There needs to be a monitoring system because, *the marble*, (the (movement) action object) can and will deviate now at any place P within the action trajectory. That is why the explanatory model comes to the conclusion that *a* part of the monitoring system must be occupied intensely with the actual place of the marble but in a narrow relationship with the whole marble trajectory shape and that *a* part of the monitoring system must be occupied intensely with the action trajectory shape but in a narrow relationship with the actual place of the marble[171]. And in that way the explanatory model shows that a continuous mutual relationship needs to be there in which one part has a direct influence on the other part. When the actual place of the marble deviates in any way from the perceptual image of the latent action trajectory shape then immediately a new perceptual image of a latent action trajectory shape needs to be constructed which the marble is obliged to follow again[172].
So out of the assumption that *somewhere* such a *functional* monitoring system needs to exist the explanatory model creates a link with the current *physiological* explanation within scientific research concerning the ventral and dorsal stream. In which the dorsal stream is mainly connected to the actual place of the marble and the ventral stream is mainly connected to the whole marble run trajectory shape. The current explanation within science is now approaching the clarification of the explanatory model in an amazingly close way but because again a strict framework of the explanatory model is still missing the discovered phenomena within current scientific research maintain to keep the feeling

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every place P and so one is never able to pretend that there is such a thing as a set ball trajectory shape. So conversely to the BDT the deviation is not situated within the perception of the catcher. Just like Gibson theorizes the visual perception is direct. The deviations are caused by the ball itself and nothing else. It belongs to the one *affordance* that is handed to us in the animal-environment relationship and that is and will remain an autonomous entity which we will never be able to influence. From an initial beginning we are able to quickly classify ball trajectories into, *precise global*, *reference* (!) ball trajectory shapes but we will never be able to foresee how the ball will precisely fill its trajectory beforehand. So we are not able to do more than to create a *precise global* image in the beginning of an incoming ball trajectory shape. Later on we are able to make more precise predictions but until the last point P a ball will and shall be able to deviate.

[171] This looks like a *double*, pointless, system but it all has a function. When I want to grab an apple out of the basket it normally will occur in a set orderly manner but it is also possible that somebody suddenly blocks the basket or the apple is able to suddenly start to roll. And besides that both can occur at the same time. (When a lion is hunting the prey will also start to *roll* sooner or later). Then one needs to be able to quickly construct new latent action trajectory shapes out of two perspectives. The explanatory model regards this system as maybe the most elementary ecological phenomenon because it depicts a very advanced system which explains all possibilities within the *animal-towards-the-environment* relationship as well as all possibilities within the *environment-towards-the-animal* relationship as well as all combined possibilities.

[172] The ecological origin in here is explained out of an efficient and effective, a *parsimonious*, approach. When I want to grab an apple when I am still at a 5 meter distance there is no need at all to cognitively know or calculate the exact best action trajectory shape which leads to the apple. In the beginning of that action a quick parsimonious system will just allow me to come closer to the apple, with the help of a *precise global* action trajectory shape, in which the shape only needs to become more and more precise when the shape progresses.

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of general *assumptions* (!). And that is the main reason why this scientific research is also not able to come to a final completion.

However the main question will maintain to be if the mutual process, which is regarded as a crucial part within the actual movement action of the explanatory model, has a relationship with the processing processes of the perception because the explanatory model doesn't make statements about the physiological origin of the perception but only about the functional origin. But before I continue with that I will first outline in brief my history in here.

"That is, the ventral stream permits the formation of perceptual and cognitive representations which embody the enduring characteristics of objects and their spatial relations with each other, whereas transformations carried out in the dorsal stream, which utilise the instantaneous and egocentric features of objects, mediate the control of visuomotor actions. Furthermore, they contend that neither stream works in isolation but they engage in extensive orchestration. It is important to note that the successful selection of the correct movement programme is dependent on skilled perception of ball flight characteristics[173]*. Abernethy and colleagues (e.g. Abernethy 1981, 1987a, 1987b; Abernethy and Russell 1984) have pointed out that the time constraints of fast ball sports are so restrictive at the highest levels of performance that it is not feasible to readily modify the duration of parts of the movement*[174] *(e.g. quicken one phase of a biphasic batting action). This type of variability would increase the programming demands upon the performer. Rather, the skilled athlete is one who 'buys' time by exploiting the advance signals emitted by the movements of opponents for decision-making and preparation of a response. Skill in rapid interceptive actions, such as catching and hitting a ball, is based upon the ability to detect and interpret perceptual information through a comparison with an internalised memory structure based on past experiences in similar situations. Top class players have developed highly sophisticated models of the world which allow them to predict events and to select preprogrammed sequences of movements specifically designed to carry out interceptive tasks. This explains why skilled athletes never seem to merely react to unexpected events, but appear to operate in the future. They use an 'anticipatory mode' of action (Whiting, Alderson and Sanderson 1973)."* [175]

In 2008 the beginning of the idea arose within me that within tennis a ball is glued to its ball trajectory shape. Later that idea became the fact that a ball is situated at the front of the actual ball trajectory shape but also is bound to follow the embedded whole shape of the ball trajectory out of the initial phase of that ball trajectory in a *precise global* way. That opened the way to construct a perceptual image of the latent ball trajectory and that again opened the possibility to create a mutual relationship between that perceptual latent image and the actual image of the ball trajectory shape. That mutual relationship is what I also showed with the example of the marble run in the beginning of this addendum. This never remarked mutual relationship is one of the essences of the explanatory model and is the key issue in here because this mutual principle can be linked to all Motoric Movement Actions and especially to all catch actions. The Motoric Movement Action *catching* encompasses within there all actions which we perceive in every environment/vista towards our position or our action trajectory from the earliest development of organisms and is so essential for the explanatory model that it even links the origin of the visual perception organ to that mutuality[176].

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[173] Till now it amazes me that *the ball flight characteristics* in also this scientific research are noticed but that it was never deepened into more detail. Therefor no scientific research was ever able to discover the significance of the movement action (MA) and the corresponding *tau*-value ($tau^{G}{}_{MA}$).

[174] Because the explanatory model is missing, scientists try to classify the found phenomena within logic reasoning. In this case that leads to an essential wrong assumption. The explanatory model clearly shows that the whole system is developed to optimize the *functional tau*-coupling. In which the one-dimensional *tau*-coupling even can be understood as a basal *reflex*-system. During match play elite players are aligning themselves to average *tau*-values which they expect in specific game situations but for years they train to be able to conversely deviate from these averages within the actual game situation and to optimize the *tau*-values. So for the explanatory model it is very *feasible* that elite players are able to execute that and conversely states that elite players on purpose train that *feasibility* for years.

[175] A.M. Williams, K. Davids, J. Garrett; Visual Perception and Action in Sport; p.78.

[176] The severity which the explanatory model links to the actual movement action would also completely fit

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Elite players within tennis are able to make *precise* statements about the *global* progression of the latent parts of the ball trajectory shape based on better experiential knowledge and that is why they can play the game optimally because they are able to anticipate in a maximal way (*'anticipatory mode')*. At that moment, which I later appointed as the constructing of the latent perceptual image of the ball trajectory shape, I already assumed that this perceptual image of the ball trajectory shape needs to be observed with direct perception, *online* perception processes, as well, because I already understood that this perceptual image only could serve as a, *precise global*, *reference* ball trajectory shape[177]. It could provide a sound indication of what you globally could expect but of course that, *future*, image would never be able to provide all, *actual*, deviations. Although I used to read scientific papers I now started to look for specific scientific sources which were able to provide back up to my *functional* conclusions.
To my big surprise I was confronted with the perception-action dichotomy, also mentioned in the aforementioned quote, during that assignment from which I had to draw the conclusion that science hardly had any awareness of the obligatory essential mutuality within the phenomenon I already had appointed. As the explanatory model now clearly shows you are only able to establish a *tau*-value when there is a strict cooperation of a perceptual image and an actual image of the action trajectory or the movement trajectory. Because line segment shapes weren't recognized within current science both sides within the dichotomy weren't able to discover that they both were legitimate and even vital but were *just one part* of a bigger holistic phenomenon.

"More recently, Milner and Goodale (1995; M&G) have argued that the 'what versus where' model fails to capture the essential difference between the functions of the two streams. In contrast to U&M's emphasis on the parallel processing of incoming information about different visual attributes, M&G's (1995) perception/action model focuses instead on the different output requirements of the streams. Indeed, they propose that both cortical streams process information about the intrinsic properties of objects (e.g. size, shape, and orientation) and their location, but that the transformations they carry out are matched to the distinct purposes for which each stream has evolved: the dorsal stream for the control of visually guided action and the ventral stream for the perception and recognition of objects."[178]

While reading about the perception-action dichotomy I was regularly confronted with scientific research concerning the processing processes of mainly the visual perception. This research tries to explain the functionality of the perception processes out of the physiological functioning of these perception processes. Within that explanation it was noticeable that, different to the perception-action dichotomy, they aimed at explaining the visual perception in general and that the Motoric Movement Action wasn't awarded the centre of attention. Also within this research the same deficiency as within the perception-action dichotomy could be noticed. I observed the same struggle. Many individual components of the explanatory model are indeed/absolutely appointed but the overarching clarification of all those separate components within the explanatory model hasn't been found and that is why the discovered phenomena can't be classified in a definite way. Within here scientists are also just able to appoint *probable* relationships, *probable* assumptions, between certain aspects and therefore are also incapable of establishing purposeful ending sequences of research questions. With the explanatory model this all will change from now on.

Before I will continue with these experiences I first want to remark at this point that the human body did its utmost to make the quest to the right explanatory model as hard as possible. If all processes function in the way the explanatory model describes then two systems can be mentioned which could be seen as perfectly disguised. As if the body didn't want that anybody would discover them. They implicitly are a huge pat on the back of the evolutionary development of the human body because till now they were able to keep scientists from the truth in these basal matters.

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within the severity which current science links to the processing processes of the perception.
[177] Also see: "Watch The Ball Trajectory!"; Chapter 10.8; *Reference ball trajectory shapes*.
[178] Rogers, G., Smith, D., & Schenk, T.; *Immediate and delayed actions share a common visuomotor transformation mechanism: A prism adaptation study.* Neuropsychologia, doi:10.1016/j.neuropsychologia.2008.12.022

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One system has to do with the never noticed phenomenon of the two foci. The explanatory model demands two foci within the execution of every Motoric Movement Action. Because it looked simple and because we were able to execute it easily we always thought that we manipulate the food in a direct way within the Motoric Movement Action *eating*. But nobody is able to do that. We are only able to directly perceive the movements within the line segment shape of the food, outside our body, and to indirectly manipulate this line segment shape with *much different other movements*, within our body, which we always perceive in a proprioceptive way. So within eating one focus needs to be pointed at the *food* trajectory shape in which the food is moving and at the same time another focus needs to be pointed at the motoric movements (MM) which execute this *food* trajectory shape. However human beings are not capable of constructing two separate images of two separate foci at the same time. At least we create one complex focus image[179] of both foci and that is why it looks that only one focus is involved.

Within the processing processes of the perception, the other system, it is maybe even more ingenious than the aforementioned foci. If it works exactly the way the explanatory model describes then we also create one complex *total* image of both the manifest as well as the latent action trajectory shapes of all moving ob-/subjects. So according to the explanatory model we perceive the actual place and a part of the manifest action trajectory shape of the (movement) action object in one image but at the same time we also perceive a perceptual image of a latent action trajectory shape which will/must arise out of the manifest part or the initial phase of the action trajectory in that same image. Maybe even more than within the complex focus image within the aforementioned foci the creation of this total image is the deliberate intent of the body. Within the complex focus image both foci need to be observed simultaneously and are part of one action but they remain completely separated phenomena. Within the processing processes of the perception the ventral stream has the main goal to map the action trajectory shape but needs to keep a direct relationship with the actual place of the (movement) action object within that ventral stream. And vice versa the dorsal stream mainly needs to be occupied with the actual place of the (movement) action object but also needs to keep a permanent direct relationship with the action trajectory shape within that dorsal stream[180].
The fact that within the separate streams the relationship with the other stream must be monitored in twofold could possibly imply that one of the essences of the processing processes of the perception is to implicitly construct *tau*-values[181].

"A 2010 review of the accumulated evidence for the model concluded that whilst the spirit of the model has been vindicated the independence of the two streams has been overemphasised. Goodale & Milner themselves have proposed the analogy of tele-assistance, one of the most efficient schemes devised for the remote control of robots working in hostile environments. In this account, the dorsal

[179] In *Caught In A Line* a comparison is made how experienced jugglers visualize a cascade with three balls. Starting jugglers will often focus at three separate ball trajectory shapes. It is very likely that experienced jugglers will also focus at just one combined *total* image within the movement action (MA) in which three action trajectories are present. It is the more likely because during juggling one needs to point the primary focus at this total image and besides that one also needs to point the secondary focus at the motoric movement (MM) which has to execute the movement action (MA).
[180] The thought processes which lie at the basis of The Quiet Eye (TQE) could very well have a relationship with this ingenious phenomenon within the processing processes of the perception. Many scientists already suspect that the body implicitly combines *some things* together and claim that if you *quiet down* the body it will autonomously perform that *trick* (!) whatever it may be. And within very simple Motoric Movement Actions that indeed happens. If for example you have to put a golf ball within 30 centimeters from the hole your body is automatically creating a correct latent action trajectory shape out of the actual place of the ball and if you are going to actually execute that shot your body automatically links the actual place of the ball to the latent ball trajectory shape. And that also will be executed very easily because the involved distances are conform the distances we bridge in many daily actions. But because we didn't know what we exactly were executing during that simple task we were not able to modulate that to more complex actions.
[181] Now I am able to separate the two foci when for example I am executing the Motoric Movement Action *eating* and really experience the two different attention areas. Till now I never succeeded to observe the independent processing processes and maybe the human body definitely terminated that possibility.

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stream is viewed as a semi-autonomous function that operates under guidance of executive functions which themselves are informed by ventral stream processing."[182]

Still the fact remains that the explanatory model just explains and doesn't prove anything. However the clarification of the processing processes of the perception fits perfectly within the whole model and is completely congruent, coherent etc. with the observations within scientific research in such a way that one is able to suppose at least that there must be compelling relationships between the two based on logical grounds. And that minimum will take care of the fact that with the explanatory model the aforementioned phenomena will soon be definitely explained within scientific research. The exact physiological processes will need much longer scientific attention but the explanation of the majority of the functional processes will now soon be finalized.

In conclusion I will appoint two phenomena which scientific research concerning the evidence concerning the processing processes of the perception will also have to address.

- The explanatory model shows clearly that a *tau*-value can be established by just observing the line within an action trajectory shape. This is a very simple task and that explains why even preschoolers are able to hit incoming badminton shuttles or tennis balls within one lesson. So at that age they are already able to establish a *tau*-value within the incoming ball trajectory shape as well as within the movement trajectory shape of their racket and are even capable of (*tau*-)coupling them. However the only thing they are capable to do is to just hit the (movement) action object and it will take many more years before they even comprehend which complicated shapes can be involved within the game of tennis. For the basal *tau*-value the emphasis must be put on the word *line* and for playing the game of tennis the emphasis must be put on the word *shape* within the action trajectory line segment shape or the movement trajectory line segment shape. Of course the scientific question within this phenomenon is how this reflects on the processing processes of the perception. Do they both belong to the processing processes of the perception? Does the one-dimensionality of the *tau*-value has a link with evolutionary earlier developed brain regions (reflex-brainstem)? Do we also create a more complex *tau*-value of the (line segment) shape besides the one-dimensional *tau*-value of the line (segment shape) and if so how is that linked to our cognitive knowledge?
- At first the ventral and dorsal stream were explained towards the processing of the visual perception within scientific research. Later the auditory perception was also connected to the processing processes of the perception. The explanatory model is agreeing completely with those conclusions. In this addendum the nightly mosquito[183] is frequently used as an example and these examples show that we are able to establish action trajectory shapes, although in a significant inferior way, within the movement action (MA) based on auditory perception. The explanatory model even wants to take one more step and also wants to link the proprioceptive perception to the processing processes of the perception.
  Current scientific research splits proprioceptive perception into *limb position* and *movement*. That is how much current science has discovered to this moment. The explanatory model clearly links those two phenomena to the motoric movement (MM) within the Motoric Movement Action but besides this the explanatory model also shows that we are able to construct perceptual images of latent action trajectory shapes within the movement action (MA) based on proprioceptive perception. If we need to open a strange positioned door lock with a key at a unfamiliar door in pitch black darkness we normally probe the door with our non-key hand first to determine the position of the lock. Then, if we finally localised the lock (bottom left!?), we create on the basis of our proprioceptive perception of the two hands (or better based on the proprioceptive perception of the fingertips of the non-key hand and the tip[184] of the held key in the other hand) an action trajectory

[182] McIntosh, RD.; Schenk, T. (May 2009). "Two visual streams for perception and action: current trends.". Neuropsychologia. 47 (6): 1391–6.

[183]

[184] Within the use of a flexible (motoric) movement object (for example racket, pen, spoon, blind man's cane etc.) the proprioceptive perception will continue within the object. Due to proprioceptive perception of the tip of

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shape between those two body parts. If we subsequently are going to execute the actual movement action then we are able to successfully adjust the action trajectory shape according to the continuous mutual process within the processing processes of the perception with the help of that same proprioceptive perception.
So the explanatory model shows that the proprioceptive perception can be involved in many phenomena within the Motoric Movement Action and shows in this task for example that the secondary focus must be pointed at the primary focus with both the proprioceptive perception as a basis.

the cane as well as the proprioceptive perception of their shoes (a shoe, although being passive, is also a flexible (motoric) movement object) visually handicapped people are able to also shape an action trajectory shape between these two body (!) parts.

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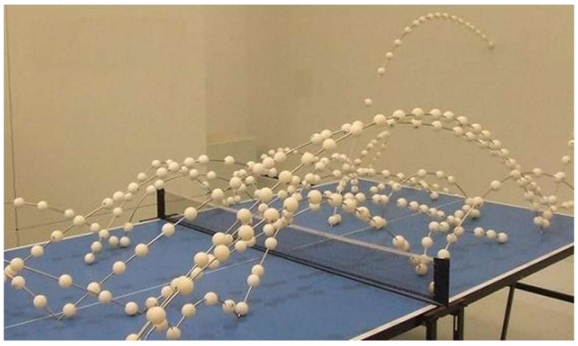
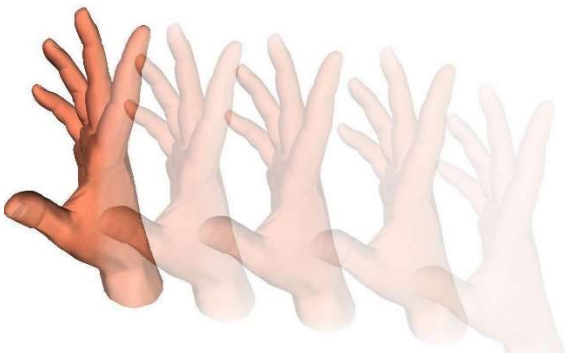
Appendix A – The ball trajectory shape

1. The ball trajectory shape
2. The *tau*-value of an incoming tennis ball trajectory shape versus a Z-ball trajectory shape within regular tennis
3. Playing regular tennis with a tennis ball versus playing the game of tennis with a Z-ball

Wherever you are or whatever you do you will always be part of an environment/vista. The next two phenomena concerning this environment are hardly recognized anywhere.

1. You will always perceive a vista in *linear* movements[185]. If we limit ourselves in there only to the visual perception then you will see either ob-/subjects move or that they remain, are standing still, at their exact same spot. In which standing still, out of the principle of relativity, scientifically must be seen as a zero-movement out of the specific beholder. If you think about riding your bike. For you the bike is standing still but for the other person it's not. So your visual perception organ will create, always in the same active way, ongoing sequences of still standing static images which out of your perspective either in comparison of these images show a 0-movement or in comparison of these images show a linear movement[186].





Images: If you look at a picture you think you are experiencing one representation of one point in time. It could provide the suggestion that if you look at an image of multiple table tennis balls or hands that movements in *linear* line segment shapes are involved. You are able to perceive movement but that is just an illusion. If you look at these pictures your visual perception organ produces like within all pictures continuous sequences of static still places of *the same picture* (!). Within there the visual perception organ will never be able to perceive a difference in places P in the continuous comparison of those separate static still images and that's why it looks like we are experiencing one representation of one point in time.

Ob-/subjects which out of your perspective are (still) standing still show with their consecutive places P, in contrast to moving ob-/subjects, no deviations of those places P and will not create

[185] Within an ecological approach this fact can be linked even to the earliest forms of life. Before the evolutionary development of perception one can deduce out of this proposition that differences in places P could already have led to the *sensation* of movement/change. So that is in the eras long before one was cognitively able to perceptually lengthen a manifest line segment shape or one was cognitively able to determine what was moving. In those earliest times the only thing that mattered was *if something changed* in relationship to the position of the animal.

[186] The explanatory model concerning Motoric Movement Actions mainly considers the visual perception organ as a *comparison*-organ.

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a line segment or will show a zero line segment shape. Or in other words all places P(x) *must* be connected to the exact same place P(x) within the visual perception. Ob-/subjects which out of your perspective are (already) moving conversely show a line segment shape in which the places P(x) are always connected to the places P(x+1) and P(x-1). So all ob-/subjects which out of your perception perspective move are *caught* in lines because they not only shape the line but they will also have to follow the perceptual line segment image that you shaped because no ob-/subject is yet capable to jump from P(+1) to Q(+6) to R(-16) etc.. So balls will always be connected to *linear* (ball trajectory) shapes and the same can be applied to all actions which we execute with our body in an environment[187]. If we kick a ball with our feet or if we grab an apple with our hand all consecutive places P of the foot or the fingertips are also linked in such a way that you perceive them as line segment shapes. In the case that we want to clap behind our back or if we want to dispel a nightly mosquito from our head, ergo if we execute an action towards our own body, then we need to observe the action out of the (movement) action object and then is the environment the location of where the end of the action trajectory shape is planned. So in case of the mosquito the action trajectory must be shaped out of the perspective of the relevant parts of the hand through the *nothing* towards our head.

2. Classic explanations connect the initiative within an action mainly to the animal towards the environment. According to those explanations the action finds its origin in the formulating of an egocentric will within the animal. Conversely J.J. Gibson with his *The Affordances Theory* emphasizes that the environment is providing the *possibilities/affordances* and that an action must be assessed much more from an animal-environment relationship. However within his exposé one can notice that he either puts the attention on the animal side or on the ob-/subject in the environment side. So if an apple can be grasped then Gibson mainly points at the specific possibilities within the apple that will provide the opportunity to grab it.
   The explanatory model doesn't contradict with that view at all but conversely adds an extra and final step in here as well and notices that Gibson neglects a very important third entity which, besides the animal and the environment, is blatantly present. In every environment/vista there needs to be an obvious space with *nothing*, between (!) the animal and the environment, to make movements possible. Without empty space (*manoeuvring room*[188]) movements wouldn't exist and due to that the Motoric Movement Action wouldn't exist. So the explanatory model acknowledges three obvious entities in each vista/environment. The animal, the environment and the *nothing* between the two of them and clarifies that the *nothing* shapes the relationship between the animal and the environment. The explanatory model even wants to express that more profound by stating that the nothing *is* (!) the relationship between the animal and the environment. The explanatory model acknowledges those three entities completely and that is why they all together shape the essence of one of the two complex subsystems, the movement action (MA). Within the movement action (MA) they are moulded to one overarching entity, the *action trajectory shape*. The ball trajectory shape is the specific action trajectory shape within ball sports.

This appendix will further appoint the ball trajectory shape. It is the specific action trajectory shape (MA) within ball sports. A general explanation will follow why and how we are able to play games with it. The explanation concerning the use of a Z-ball is used to illustrate the boundaries of the human capabilities concerning our perception processes within there. The Z-ball shows exactly what we are

[187] The explanatory model adds one new insight to the *animal-environment* relationship. Within Motoric Movement Actions there is either a clear action from the animal towards the environment or a clear action from the environment towards the animal. In that way the explanatory model explains that there are two main groups of actions, namely the throw and catch actions. Although both need timing and therefor a *tau*-coupling the, self-initiated, throwing actions can be defined as the actions with *self-paced* timing.

[188] Also think about the water in the swimming pool. Just like we are confronted with or daylight or darkness from the earliest times, so the earliest organisms are familiar with two kinds of *nothing*. From the earliest evolutionary developments we either make actions in the water or in the air.

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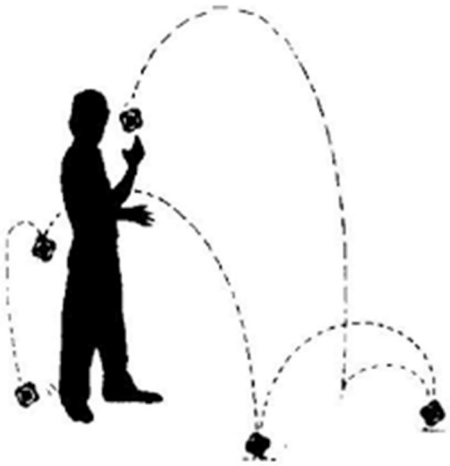
not able to perceive and conversely shows exactly what our perception processes must actively (*The Active Eye*) execute during the playing of a regular game of tennis.

1. The ball trajectory shape

Every moving ball leaves a trail. A *Z-ball* will show a strange and irregular pattern. But this ball also created a ball trajectory. If one could throw a Z-ball at the exact same place the ball trajectory would show big differences with the previous one. No pattern will occur in the innumerous possibilities this ball hosts.
Moving tennis balls however do show regular patterns. A tennis ball is a smooth round ball. A tennis ball has a set relationship for every time (t) with a certain place (P). For t(0) →P(0); for t(1) →P(1); for t(2) →P(2) etc.. Ball trajectories are projections of all the points P the ball will encounter in time. They show a recurring steady pattern. A reproduction of a ball trajectory will globally show the same characteristics. If that wasn't the case tennis couldn't be played. When a ball trajectory is actually produced the ball is in front of the ball trajectory. The ball has relations with all times $t \geq 0$ and all places P. But a ball has also relations for every time $t < 0$. So for t(-1) →P(-1); for t(-2) →P(-2) etc.. After the initial phase, the phase where the ball trajectory is produced, a ball trajectory cannot be adjusted anymore like they are able to do in the sport curling.

Z-ball



Z-ball bounce behaviour

Image: The Z-ball shapes a *linear* action trajectory like every moving (movement) action object. Every place P(0) is always connected to the places P(+1) and P(-1). However no set pattern will occur in Z-ball bounce behaviour. That is why mere mortals are not able to create a *precise global* image of the whole latent part of the action trajectory shape. The cognitive basis in humans is not able to translate this ball behaviour into complete predictable lines. The cognitive basis is only able to predict the *precise global* bounce behaviour till the first bounce out of the initial phase, the first part, of a ball trajectory. Conversely to that prediction one is able to construct a *tau*-value before the bounce of how this not-predictable shape will be filled after the bounce. Just like with a regular tennis ball this *tau*-value before the bounce will have a direct relationship with the *tau*-value after the bounce because the *tau*-value is only determined by the one-dimensional filling of a line segment and is not dependent on the shape of that line segment. Within the use of a tennis ball the shape of the ball trajectory after the bounce can be predicted in a *precise global* way due to the shape of the tennis ball and its corresponding ball trajectory shape behaviour (!).

So it is very well possible to make statements about the shape of a tennis ball trajectory even if one only knows the beginning of a ball trajectory. One can precisely predict the global shape of the ball trajectory after the bounce. And vice versa from the end of a ball trajectory one can precisely predict

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the global shape of the beginning of that ball trajectory. So perception mechanisms will be able to precisely predict the global shape of the latent end of a ball trajectory when a ball trajectory is just produced. That is the main premise of the explanatory model of the Motoric Movement Action. The ball is going to make its ball trajectory but also casts its shadow forward. A *precise global* shadow. A precise global *marble run*. The initial phase is determining which whole shape the ball must (!) follow. That is why the ball has a continuous mutual relationship with its ball trajectory. The ball actually shapes the ball trajectory but has to follow the perceptual image of the latent part of the ball trajectory shape as well[189].

"Because of this a few important conclusions can be drawn. A moving ball in tennis is always inseparably connected to its trajectory. The ball trajectory. The ball is leading and determines with its place in the ball trajectory the spatio-temporal actions which the player actually has to fulfil. But the ball trajectory is also leading. The shape of the ball trajectory will tell where the ball will be in the near future. A sound visualization of the shape of the ball trajectory out of the Initial Phase forces a ball to follow that visualization. That is a new and a little bit odd perspective. This book will clarify this completely. It has to do with the fact that elite players continuously will have to create perceptual images of near-future places of the tennis ball based on the expectations of the ball trajectory shape but they will have to actually check[190] these expectations continuously as well. It has to do with the many kinds

[189] So this is a subjective phenomenon because it is based on accumulated experiences. The more (explanatory model based) experience a player has developed, the more the player will be able to estimate the fluctuation borders of occurring deviations in both the ball trajectory *shape* (!) as well as the hitting technique. This has a direct relationship on the optimization process within the Motoric Movement Action. This underpins the phenomenon that elite players own more (much more!) and qualitive better knowledge. This is completely in line with all acquired research data which also show that even the best elite players are dependent on this optimization process and that in complex sports there is always a success rate present. These observations undermine for example The Quiet Eye (TQE). TQE states in fact that we don't need any experience but that the execution of a Motoric Movement Action is dependent on a *state of being*. TQE is crucially not able to explain why this state of being in one case leads to a success and in the other case doesn't. If it would be a *simple mental trick* then you should always score that free basketball throw, won't you?

[190] The explanatory model of the Motoric Movement Action will definitely end the perception-action dichotomy. It will show that even the simplest action is dependent on a strict cooperation of top-down as well as bottom-up perception processes. Balls are in fact autonomous entities and will always show deviations within their consecutive places P. Even if a tennis ball cannon will fire the same tennis ball in the same position endlessly no ball trajectory shape will ever be equal to the other. Therefor these, *always*, occurring deviations will, *always*, have to be perceived.

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of perception processes which actually exist. In retrospect we can conclude that the position of the perception (P) in the old tennis action was far too limited. I will prove that the perception is controlling or better predominating the whole process."[191]

The ball is part of the movement action (MA). Only the ball shapes the ball trajectory with all its consecutive, still standing, static places P. The ball is a completely autonomous entity[192]. If we develop an egocentric will to do something with the ball then we have to appoint the movement of the ball out of the perspective of the ball. At this point Roger Federer, see photo image, could also decide to not hit the ball[193]. For the ball trajectory as well as Federer's observation of the ball trajectory shape that makes no difference at all. Because the movement action (MA) of the Motoric Movement Action *catching*[194] is identical to the movement action (MA) within the Motoric Movement Action *not-catching/fleeing/avoiding.*

"The ball has a mutual relationship with its ball trajectory. The ball shapes the ball trajectory but also has to follow the during the Initial Phase established shape. A ball trajectory shape is the result of all the separate successive positions of the ball. A photo of only one ball in that ball trajectory only says something about the place of that ball. If one would only look in that way to all the separate ball positions than the receiving information would only be complemented with every new position of the ball. The consequence of such a view would be that a player wouldn't be able to anticipate and would have to structurally look at the ball. That this is not the case we already can experience in the direction anticipation of beginners. Even beginners react in an early phase if they have to perform a backhand or a forehand stroke[195].

Images: "A ball trajectory shape is the result of all the separate successive positions of the ball. A photo of one ball in a ball trajectory only says something about the place of that ball".

A player needs to know everything about ball trajectories. It is the action trajectory with which you play the game. The cognitive base requires a huge reservoir of knowledge about these line segment shapes. The cognitive basis must give the answers of the how and why of all existing ball trajectories. This information must be complemented with abstract knowledge of ball trajectories. The Tactical

[191] "Watch The Ball Trajectory!"; p. 22.
[192] It is like the water in the mountain stream. We can do something, nothing or let another do something with the direction of the water. But the thing we are not able to control is the matter, the water, itself.
[193] The conscious decision to not catch a ball is for example a very important part of the sport *dodge ball*.
[194] See appendix B for an extensive description of the Motoric Movement Action *catching*.
[195] And the cause of that is that the *direction* (!), as a ball trajectory defining factor (BTDF) within the *shape* of the ball trajectory, can be determined very quickly during the beginning of the initial phase.

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Tennis Action demands knowledge about the intrinsic value of the incoming ball trajectory and the outcome of the outgoing ball trajectory in relationship to the position of the opponent. The Actual Tennis Action demands to connect many different incoming ball trajectories to many different outgoing ball trajectories. The player must be able to execute it all with technique."[196]

With these last observations the explanatory model also reveals the origin of the function of the visual and motoric system[197] because the explanatory model brings back every *animal-environment* relationship to the Motoric Movement Action *catching*. The earliest organisms were of course 1. dependent on the quality how they experienced in which way other creatures or objects could interfere with their action trajectory or their position and they were 2. dependent on the quality of the locomotor apparatus to either contact that movement (eating, mating) or to not contact it (being eaten). So the general function of the visual system in this task is to constantly[198] (!) map all movements[199] and to perceive when this could lead to a confrontation. The function of the motoric system is therefore to either encage or to deliberately not encage this confrontation. Or in other words to catch or to flee/avoid/not-catch this confrontation[200]. Important though is the conclusion that the movement, either away or to an object/subject, is part of the motoric movement (MM) and that the movement action (MA) in both options is exactly the same.

2. The *tau*-value of an incoming tennis ball trajectory versus a Z-ball trajectory within the regular game of tennis

In this section I will assess one exact equal incoming ball trajectory shape with a bounce (!) within the regular game of tennis and in there I will appoint the essential differences when that happens with a normal tennis ball versus a Z-ball. The assumption is that the bounce behaviour within both balls are comparable.
As soon as possible an elite tennis player will try to mold an incoming ball trajectory into a *precise global* shape of a specific, intensively trained, *reference* ball trajectory and during that task he will witness the closing of the gap of the latent part of the ball trajectory line segment until the bounce in the exact same one-dimensional way with both balls. Also in the same way the *tau*-value of the ball trajectory after the bounce can be determined based on cognitive knowledge concerning the bounce

[196] Introduction chapter 10 of "Watch The Ball Trajectory!"; The GBA – consequences for daily practice - Ball trajectories.
[197] It shows many commonalities with *The Affordances Theory* of J.J. Gibson. But in comparison to Gibson the animal-environment relationship is now fully incorporated into the explanatory model. The explanatory model in here also shows that it is coherent, congruent etc. to already widely scientifically accepted explanations. Also in here the explanatory model goes one step further and combines all these random islands of knowledge to one consistent whole within one set frame.
[198] An essential, in this context never used, fact is that the visual system is indeed producing one static image of the environment every time segment but that that is not the essence of the visual system. For movement, and so also for 0-movement, the visual system needs to actively *compare* (!) these static images (also the static places P of an apple in the fruit basket are actively compared with each other). This aspect differs completely from Gibson's theory because it shows that we don't need to move to perceive. Movement or *the* moving is ingrained/embedded in the visual organ itself. Or with other words the visual organ itself *moves* by producing continuous sequences of static pictures. In that way the explanatory model undermines the assumed equality of 1. the perception and 2. the movement and its assumed mutual relationship and so the explanatory model comes to the conclusion that the perceiving of movement is originally the primary task and therefore deserves the primary focus and that the motoric movement (MM) is dependent on what *confrontation* is being detected. So the secondary focus must be pointed at that part. It is completely in line with the explanatory model. If we for example have to flee than of course we need to keep the primary focus on the action trajectory of the tiger and the secondary focus must be pointed on our movement trajectories in the direction of the transition point (the intersection point of the lion's route and our route) towards the action trajectory of the tiger.
[199] If one accepts the assumption that an assumed static object/subject must be regarded as 0-movement, in relationship to the theory of relativity, than in fact everything moves in an environment.
[200] This very simple evolutionary explanation can be demonstrated quite easily and forms with its simplicity a sound explanation of an ecological approach.

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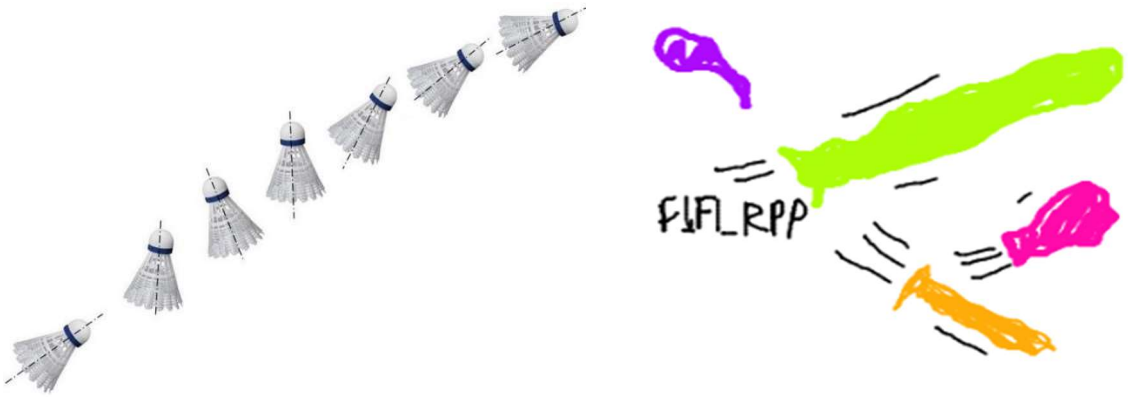
behaviour of the (movement) action object. So just like with a tennis ball we are able to also shape a *precise global* image of how a Z-ball will one-dimensionally close that gap after the bounce. However the only thing what mere mortals cannot do in there is to construct a *precise global* image of the shape of the Z-ball trajectory after the bounce. The shape of the bounce can still be predicted quite well but behind that point no, set, Z-ball bounce behaviour can be recorded into our cognitive basis. So we are able to construct a *precise global* image of the closing of a gap of the whole ball trajectory but we are not able to link it to a whole *precise global* Z-ball trajectory shape[201] if the opponent just struck the ball. Z-ball bounce behaviour in relationship to the *shape* of the trajectory is just too chaotic, too complex, for our perception organs to be able to record anything in our cognitive basis. So we are only able to start to construct a *precise global* latent image of the shape of the incoming Z-ball trajectory after the bounce[202]. Because only from that time on we are able to start to construct a latent image of an intersection point with an outgoing ball trajectory shape with an optimal game intention. This is due to the fact, and in short this contains the essence of this all, that only from that moment on we are able to provide such a detailed image of the fluctuation boundaries of the ball trajectory shape that we are able to *answer* (!) those sufficiently within the fluctuation borders of, our *limited* (!) technical abilities, within our motoric movement (MM).



Images: Within badminton shuttles (left) or not-tied up released balloons (right) no perceptual image of a latent ball trajectory needs to be created after any bounce[203]. However it is interesting to classify those two (movement) action objects (MA) within the range of the tennis ball, Z-ball and cricket ball.

[201] Within the Motoric Movement Action *cat and mouse game* (appendix E) the exact opposite is happening. Due to the set shape of the tube one can even construct already a *precise* image of the latent action trajectory shape in there. But the one-dimensional *tau*-value can't be distinguished very well because the melon/ball emerges out of a non-transparent tube at the very last moment.

[202] In spite of the fact that indeed the starting point of the upcoming ball trajectory is already known for quite some time. But we are not able to work with that *precise global* beginning. Cognitively the fluctuation boundaries within the perception must be narrowed much more if we want to be able to cover them sufficiently within the fluctuation boundaries of our motoric movement (MM). But in here it must be acknowledged that this fact is by far the most limiting factor concerning what ball trajectory shapes can be expected.

[203] From this phenomenon can be deduced that the bounce spot is emphasized far too much in many scientific research and learning methods. It must be regarded much more as just a specific inflexion point within a whole shape, a whole range, of coupled places P of the (movement) action object. This overarching line segment shape needs to encapsulate this bounce point within learning methods in such a way that players will understand this. It seems that elite players, within for example tennis or cricket, look at the bounce point after the saccade but to put it black/white that isn't true. After the saccade they are focussing at the *precise global* spot from which the ball will rise and will fulfil the last part of the incoming ball trajectory shape. In there they are mainly occupied with an optimization process in which they let the ball come to a pre-set intersection point (due to the tactical movement action) with the outgoing ball trajectory. The description of the optimal strategy within the Motoric Movement Action *cat and mouse game* (appendix E) shows that they execute this task with direct vision on the virtual intersection/contact point towards the outgoing ball trajectory and that they observe the last part of the latent incoming ball trajectory shape from the bounce point with peripheral vision.

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If one releases the same balloon at the exact same spot over and over again never a for mere mortals cognitively recognizable pattern of the whole object trajectory shape will be revealed[204]. A balloon however shows an even more complex pattern than a Z-ball. Because when a Z-ball just bounced the shape till the next bounce can conversely be predicted in a *precise global* way. A balloon trajectory shape will always show many erratic inflexion points due to the irregular deflation and the flexible structure of the balloon and so with a balloon there is never a moment where one is able to construct a *precise global* image of any latent shape. Also the *tau*-value is the hardest to define within the use of the balloon. With most objects one will be able to perceive a *regular deceleration* within the closing of the gap. Conversely within the balloon an *irregular acceleration* is involved and that sometimes leads to such fast speeds that mere mortals are not able to determine any *tau*-value at all. Within the range of other objects the badminton shuttle shows the largest deceleration in the *ball* behaviour and due to that it will show the largest fluctuation borders concerning the speed of a (movement) action object. This makes the task of determining a *tau*-value a little more complex. However badminton shuttle behaviour is stable in such a way that players are able to construct *precise global* images of ball trajectories which can be answered sufficiently within the fluctuation boundaries of the motoric movement (MM)[205]. So within the use of a balloon the only thing we cognitively know for sure is that also all places P of the balloon will be connected and that *a* gap is filled. However the final balloon trajectory shape will only be revealed at the moment the balloon will actually occupy a place P(x) and then there is nothing we are able to anticipate to, then no latent line segments can be constructed beforehand, and that is why human beings are not able to play any sport with deflating balloons.

With these details we are now also able to define the complexity of cricket. A cricket ball is by far not comparable with a Z-ball but it is neither a smooth round ball as within tennis. A cricket ball has an obvious seam and players are allowed, according to the game rules, to polish one side of the ball which will take care of the fact that the ball trajectory shape within cricket will show a wider range of fluctuation borders of deviations than with the use of the tennis ball. So just like within tennis an elite cricket player will be able to construct a comparable *precise global tau*-value of the whole ball trajectory but will have to consider a definite wider range of ball trajectory shapes after the bounce than an elite tennis player has to do. Although elite players within tennis and cricket in general already shift their attention to the catching process[206] one can determine that cricket concerning this phenomenon is more complex than tennis. That means that cricket players for example need to emphasize the receiving process more and/or better, or that they have to adjust their game intentions to the corresponding (higher) error rates, etc..

3. Playing regular tennis with a tennis ball versus playing the game of tennis with a Z-ball

Of course we all have a feeling that we can't play tennis with a Z-ball but this section will exactly show which facts underpin this feeling. It will show why the playing of the game of tennis with a tennis ball, as a very complex process, just can be kept within our human capabilities and why the playing with a Z-ball can't be kept within those capabilities. Besides that it provides a complete insight in the

[204] In here the contrast should be mentioned between bullets and arrows (archery). No mere mortal is able to construct any shape or any *tau*-value when a bullet is fired out of a gun. When an arrow is fired the speed is still at a pace that the shape and *tau*-value conversely can be determined. Arrows also behave like most, normal, aforementioned (movement) action objects. However the huge difference with the other objects comprises the fact that the shape of the action trajectory of the arrow provides such a small time frame that one most of the time isn't able to execute whatever motoric movement (MM) successfully ($\Delta t_{\text{action trajectory}} << \Delta t_{\text{movement trajectory}}$) if one for example wants to flee from its shape.

[205] Otherwise badminton could only be played with a very small success rate and then it would never have developed into a successful sport. So from another point of view one can determine that within most ball sports the ratios concerning the complexity, of for example the constructing of a precise global image of a latent ball trajectory shape and the *tau*-value within there, demand that they can be executed successfully for 70-90%.

[206] See: Appendix E; The Motoric Movement Action *cat and mouse game*.

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functional processes in combined catching and throwing actions in conjunction with the Motoric Movement Action *cat and mouse game*, the Motoric Movement Action *catching* and the Motoric Movement Actions of *tennis* and *cricket*. And due to gaining insight in the exact limitations one can now also appoint the maximal strategy if one really should decide to play tennis with a Z-ball.

Till the bounce of a Z-ball one is capable to make a good, *precise global*, prediction of the ball trajectory shape out of the initial phase of that ball trajectory. Out of this initial phase a Z-ball will not deviate from the movement behaviour of a regular tennis ball. However before the bounce one is not able to predict the ball trajectory shape after the bounce and that characterizes the big difference between playing the regular game of tennis with a tennis ball versus playing the regular game of tennis with a Z-ball. Mere mortals are not capable to see and/or to predict which side of the Z-ball will touch the ground and due to this fact they are not capable to predict the behaviour of the ball after the bounce. The human limitation within the visual perception organ is the cause of this.
So it is very important to notice that after the bounce one can't make a judgment about *the shape* of the Z-ball trajectory but that one can make a judgment about the *tau*-value of this trajectory. Within comparable balls with a comparable speed within an incoming ball trajectory a comparable *tau*-value will occur. So one will also be capable of determining in which *precise global* time frame a Z-ball will close the latent part of the ball trajectory after the bounce because the *tau*-value is only related to the closing of a line segment/a gap. Opposite the determining of the *shape* of the ball trajectory that is a very simple, one-dimensional, process. However with this *tau*-value one can't do much because we are not able to connect it to a perceptual image of the latent ball trajectory shape after the bounce. So we do know how *a* (!) shape will be filled in time in a *precise global* way but we do not know the shape.
So within an incoming tennis ball trajectory there is a very long route, which creates a lot of action time (anticipation time), in which you are capable to observe what the *precise global* ball behaviour will be after the bounce. In that, relative long, time we are already able to make many preparatory motoric movements (MM) which will take care of the fact that we are able to *very gradually* (!) work (technically) towards a very precise intersection point of the incoming ball trajectory with the outgoing ball trajectory. With other words the ball trajectory of a tennis ball provides us a complete marble run shape which *affords* us the opportunity to gradually connect the actual place of the ball to more and more precise latent predictions of future places of that ball[207]. With every advancing place P of the ball the actual place of the ball will deviate less from the perceptual image of the latent ball trajectory shape.
If we suppose that the time/distance ratio within one incoming ball trajectory shape from *before* and *after* the bounce is 15:1 then with the use of a regular tennis ball 16 time/distance units are provided/afforded to us to execute specific movement trajectories within the motoric movement (MM). That is the main reason why in regular tennis we are able to stay *far away* from the ball to one particular side[208] (!) because even then we are still able to very successfully cover the definite occurring range

[207] This is the essence of the underlying optimization process within all Motoric Movement Actions. Beforehand nobody will ever be able to provide a precise judgment of for example a ball trajectory shape because there are no set factors involved. One *tries* (!) to narrow down the borders of an incoming ball trajectory shape within the perception as sound as possible and one *tries* (!) to keep the fluctuation boundaries within the motoric movement (MM) as wide as possible around those borders of an incoming ball trajectory shape but that process will have to continue till the racket touches the ball. Never a set process will occur.

[208] Within the game of tennis one of the goals is to manipulate the position of the opponent in such a way that he will be able to cover his side of the court less with every next stroke. Just like many sports tennis is an excellent game because in the beginning players are able to cover the whole court reasonably well but are not able to cover it completely. A player however is bound to add a new link to the specific end of a valid chain of ball trajectories otherwise he will lose the point. That is the compelling assignment within the movement action idea (MA) or the game (action) idea (GA) in tennis. Therefor the ball reaching footwork (BRF) needs to be linked to the court defending footwork (CDF). So if within regular tennis the end of a ball trajectory shape is situated far outside the court one needs to find a compromise between the reaching of that ball at such a distance of the ball and that the court defending footwork can be optimized as well. So the distance position or the feet position in there will show a compromise between being able to hit a ball comfortably well from a set position in relationship to the

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of deviations within the incoming ball trajectory within the fluctuation borders of our motoric movement (MM), our tennis technique. The 16 time/distance units provide us the possibility to first bring the racket far away from the future contact point and accordingly bring it back.

So that's all not possible with the use of a Z-ball. If you are playing regular tennis with a Z-ball then your preparation time, just like with the tennis ball, is also 16 time/distance units but the essential difference is that you are not able to use those to prepare many motoric movements (MM). A Z-ball after the bounce creates a non-predictable, very different, shape then it is the case within a classic set marble run[209] and that makes that the visual perception within the catching process needs to start completely anew after the bounce or in other words just gets 1 time/distance unit after the bounce to perceive the shape of the incoming ball trajectory towards an intersection point with the outgoing ball trajectory shape and because of that the motoric movement (MM) only gets 1 time/distance unit as well. So within regular tennis with a Z-ball we are not able to predict many things and that is the main reason why we are not able to stay at a considerable distance from the ball and will have hardly any time available to spend on movements of the racket and that makes it rather impossible to play tennis in a normal way with a Z-ball.
So the advice is to not play the game of tennis with a Z-ball. But if you were forced to play a game of tennis with a Z-ball then the explanatory model will now provide the optimal strategy like within all Motoric Movement Actions. The optimal strategy can now easily be obtained because all functional processes are appointed.

- Because one is not able to make predictions of the Z-ball behaviour after the bounce it is advisable to achieve a distance/feet position close and/or at the bounce spot of the incoming ball trajectory if one wants to secure the highest possible touching rate. Within the return on service (ROS) that for example means that a returner needs to take a position very close to the service court area and that subsequently means that the serving player needs to serve towards/(at) the opponent to take away his space to move[210].
- Within the distance/feet position one should aim to reach a static balance as much as possible because the racket must consider, in contrast to regular tennis, a multitude of strokes after the bounce. So for example it has to remain possible to bring the racket to the backhand or the forehand side out of the same position. The static balance needs to take care of this and hopefully will provide the opportunity to create a tiny preparatory phase within the stroke.
- Because one will have to take a position close to the bounce spot there will be hardly any maneuvering space for the racket. So after the bounce, during the catching process, one needs to give the ball the opportunity to move away from the bounce spot to create that space. But in spite of the

majority of the court that must be defended later on. Under normal circumstances we therefor choose a distance position or feet position as far away from the ball as possible and as far as possible into the court in which we will still be able to cover the fluctuation boundaries of an incoming ball trajectory shape maximally within our tennis technique.
The fact that experienced tennis players, including their racket, occupy a sideward distance or feet position at the inside of the court at least one meter away from the contact point to optimize the game idea and are very successful doing so one can deduce that they must possess perceptual images of latent ball trajectory shapes (MA) and of latent racket trajectory shapes (MM). And this stems from the fact that tennis ball behaviour allows/affords this. Z-balls will definitely not allow that and this *distance*-strategy while playing the regular game of tennis with a Z-ball will only be possible if you allow a very high error rate. So the playing of the regular game of tennis with a Z-ball must be approached in a completely different strategic way.

[209] Conversely to the Motoric Movement Action *cat and mouse game* we are able to estimate a sound *tau*-value in here but that is then only the one thing we can do. However within the cat and mouse game we can predict everything about the relevant ball trajectories beforehand and that is not possible with a Z-ball. So beforehand we will never be able to know where to position in order to strike a Z-ball.

[210] It still needs to be proven but I think that, also looking at the following remarks, it will become eminent to *chip and charge* a lot.

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fact that the ball will then *move away* from the player one needs to emphasize the catching process as much as possible and not the hitting of the ball. It is the most optimal strategy which only a select group of elite players have discovered in tennis and cricket[211]. So after the bounce one needs to create a latent perceptual image of an intersection point with an outgoing ball trajectory shape as soon as possible and then mainly let the ball come to the racket in that point. And definitely not follow the strategy of the big crowd by emphasizing the racket movement towards the ball.

- Because less time will be available for the motoric movement (MM) there will be limited time to execute a preparatory and main phase of the stroke. Therefor one needs to focus to the transfer of as much impulse energy as possible during the moment of hitting in the small time frame you do have. Because that probably will not be sufficient to provide the demanded length of the stroke the player needs to execute rounder ball trajectory shapes with a bigger elevation angle[212]. These will provide a higher success rate.
- Because it will become much more complex to be able to just add one extra ball trajectory shape to the chain of ball trajectories at all, players need to dedicate their training much more to just get that first ball. So a player needs to train his condition much more towards explosive sprints which is much different to the continuous power you need in over thirty-stroke rally's which you need at clay courts nowadays.
- Although there will not exist one person with a lot of tennis experience with a Z-ball, the Z-ball bounce behaviour after the bounce can definitely be partitioned in reference ball trajectories[213]. If you want to develop good Z-ball tennis players you will have to classify these reference ball trajectories and find the maximal strategy within each game situation.

So in summary we will never be able to play the full-fledged game of tennis with a Z-ball because we are not able to construct a complete perceptual image of the whole latent ball trajectory shape out of the initial phase of that ball trajectory. In there we are confronted with the limitations within humans and subsequently with the boundaries of the Motoric Movement Action[214].

[211] See: Appendix E; The Motoric Movement Action *cat and mouse game.*

[212] See: "Watch The Ball Trajectory!"; Chapter 10.2.

[213] Reference ball trajectory shapes are the perceptual latent ball trajectories which are at the disposal of an elite player within his cognitive basis. Those are the *model* ball trajectory shapes which will provide all the standard answers in all game situations and are trained for many years extensively. Within one game situation an elite player is familiar with multiple (± 10) ball trajectory shapes which can solve a tennis problem within his technique.
Also see; "Watch The Ball Trajectory!"; Chapter 10.8.

[214] Most tennis beginners do however experience tennis a bit like playing with a Z-ball. They are still a long way from connecting the ball to a definite ball trajectory shape. They only gain input of the actual place of the ball and that causes that a beginner will only start to prepare any motoric movement (MM) when the ball bounces just in front of him. Like the formula MMA = MM x (MA) compellingly shows the beginner will have to follow the long road to disconnect the motoric movement (MM) from the movement action (MA).

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Appendix B – The Motoric Movement Action *catching* and the Motoric Movement Action *not-catching/fleeing/avoiding*

"*The second point concerns the connection between the hand and the object. When watching a fielder catching a ball one can get the impression that the ball is physically connected to the hand, even before the catch is made. It is as if hand and ball are connected by invisible elastic that draws them together. There is, in fact, a physical connection between the hand and the ball before contact is made. It is not, of course, a material connection like a piece of elastic. Rather it is an informational connection, more like that between an operator and a radio-controlled model plane."*[215]

Image: The explanatory model does exactly appoint this *invisible*, *not-material* link. Like Lee suggests in here an invisible *marble run* forms the *informational* connection between the ball and the hand. The explanatory model even goes a lot further and states that it is *the* connection (!), within this picture, of two sweetspots of the racket heads of two tennis players. And not only this, invisible, connection but every latent action trajectory shape which can be created from this service position in the direction of the returner. In here the explanatory model associates itself completely with The Affordances Theory of J.J. Gibson and proposes that a matrix of latent service trajectories occurs

[215] Tau in Action in Development; David N Lee; p. 4

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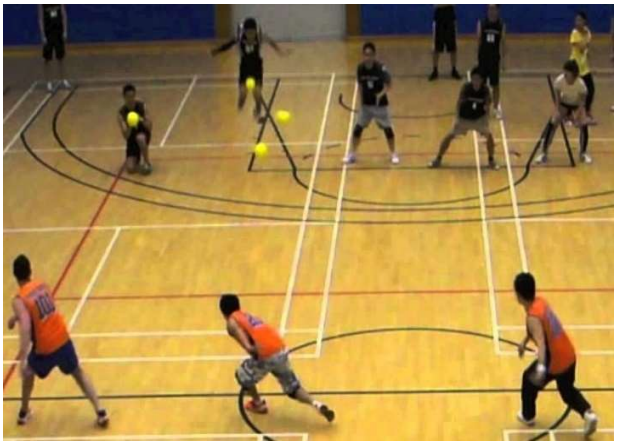
the moment these two players take their basic position. Far before any ball is hit. And so, like Gibson, the explanatory model formulates that a matrix of latent action trajectories occurs the moment an animal enters a vista/environment[216].

1. Introduction

In this appendix the basic catch action with the hand will be appointed. We are able to catch with all body parts and with the help of lots of (motoric) movement objects (racket, stick, bat, net etc.) but that all follows the catching with the hand. We are also able to catch lots of (movement) action objects. The action object in this appendix is a ball. So the task in this appendix is to catch a ball with the hand out of an egocentric formulated will to catch it. The only thing that in essence will fulfil the task is the ball. That is namely the object we want to get in our hand(s) and the ball is the only thing that will create the action trajectory and nothing else. The ball is a completely autonomous object[217]. We are not the ball, we are not able to influence it and we will never have something with it. However the ball doesn't do anything by itself. Without a ball we are not able to catch but if we don't place the (catch) hand than nothing will be caught either. Just like within all Motoric Movement Actions we will have to catch a lifeless dead ball with movement trajectories within the body which we conversely are able to control.



Images: (Left) - In dodge ball an athlete actively tries to not-catch/flee/avoid three incoming ball trajectory shapes. The intended *victim* needs to assess the shape of all three incoming ball trajectories and needs to respond with an appropriate shape within his fleeing action. The timing in there, as a part of that shape (!), mandatory dictates that the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) must approach zero sooner than the *tau*-value of the movement action ($tau^{G}{}_{MA}$) approaches zero. Or in other words the time frame in which the motoric *flee*-action (MM) is executed must be smaller than the time frame in which the original meant incoming ball trajectory shape is fully created. Otherwise he will be hit by

[216] And this can lead to a final mind twist. Namely that the original functions of the visual and motoric system, from the earliest moment, had and still have the goal to either catch something in the environment (procreation, food) or either not want to catch something (to flee) in an environment (not to become food). If one defines not-catching as a specific part of catching than one is able to determine that the whole evolution of the visual and motoric system can be explained out of the Motoric Movement Action *catching*.

[217] In here the explanatory model sees a lot of commonalities with J.J. Gibson's theory. The intention of an action can be formulated out of an egocentric will but the *visual perception* during the execution of an action focusses much more on the animal-environment relationship. After the egocentric formulation of the task the movement action (MA) therefore will mainly have to be appointed out of the perspective of that relationship. The ball, according to the explanatory model, belongs to the environment and the movements of the ball form the relationship between the animal and the environment. They certainly don't belong to the animal and therefore can't be observed out of the perspective of the animal. They can only be explained out of the relationship *between* (!) the animal and the environment.

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one or more balls. (Right) – The visual perception of a line judge in tennis is not only occupied with the specific rules of the game of tennis. In any environment it is also occupied with the latent and reactive Motoric Movement Action *not-catching/fleeing/avoiding*. This Motoric Movement Action only becomes manifest if the perception discovers that a latent part of an action trajectory, of a falling tennis player or an incoming ball trajectory shape, is able to *threaten* the individual. So this latent and reactive Motoric Movement Action must always be present in the background of all perception processes because you are not able to predict when something is going to threaten you[218]. So the explanatory model shows that we are latently fleeing/catching in every environment and in that way provides a completely new angle to the fight or flight debate by stating that they are both manifestations of catch actions.

Catching can only happen if we simultaneously keep the primary focus on the essence of the task, the ball trajectory shape, and besides that keep the secondary focus on the movement trajectories within the body that execute the catching. The secondary focus must be pointed at the biomechanical main action, within the motoric movement (MM), towards the transition point in relationship to the action trajectory. You will probably find that hard to imagine. Most people catch with a simple motoric movement (MM) and so they are able to point their attention completely to the primary focus. With the dominant hand we have combined these two foci to one complex focus image. The primary focus points its attention on the ball trajectory shape out of the perspective of the ball. The secondary focus simultaneously points its attention on the biomechanical main action of the catch technique towards the transition point (the *catching* point) of that ball trajectory shape.

Image: The role of the mouth within the Motoric Movement Action *eating/drinking* can be regarded as a catch action. Within that action all linked places P of for example a water drop or one *popped corn* shape the action trajectory. Just like within the Motoric Movement Action *pouring* the action trajectory at the water fountain becomes temporarily visible. Within the popped corn the *marble run* stays invisible. Just like within most Motoric Movement Actions.

In daily live we don't catch that much. We do catch when we hold a glass while pouring, if we hold the kettle while tapping water etc.. The role of the mouth during the Motoric Movement Action *eating*

[218] Out of this idea the thought in me arose that a matrix must be present in every vista which expresses the continuous relationships between the animal and the environment. Out of an ecological survival instinct one can easily deduct the premise that every time frame we want to know how everything in the environment can be compared in movements to our position or movements. If it shows a 0-movement we wonder if it will stay that way (or if the static lion takes initiatives to have his diner time). If it shows a movement we wonder if it will create intersection points with our movement or position (or with other words is the running lion *aiming* at us or the zebra over there?).

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can also be seen as a catch action. But they remain very simple catch actions. In ball sports and juggling a lot of catching need to happen of numerous complex ball trajectory shapes. So the catching in there can't rely on much practical knowledge. But even though that maybe the case the Motoric Movement Action *catching* is very familiar to us. That is because catching has a narrow bond with the Motoric Movement Action *not-catching/fleeing/avoiding*[219]. The movement actions (MA) of both Motoric Movement Action are identical. The only difference is that an egocentric will in catching decided to actually get something into your hands, with the help of the motoric movement (MM), and within the other to purposely not realize that goal.
However a distinction needs to be made within the Motoric Movement Action *not-catching/avoiding etc.* between an action trajectory which is purposely pointed at us or is just created in our neighbourhood. In daily road traffic the other participants have pointed their own egocentric will at going from A to B. The *tau*-values of their action trajectories only need to be marginally judged within the tactical movement action (MA). Conversely in bumper car traffic at a fair the egocentric will of the other *road users* is purposely aimed at your action trajectory or at your position. Just like in dodge ball, when three balls are simultaneously aimed at you, the motoric movement (MM) needs to make an effort to sabotage those intentions. That has the following consequences for the functional *tau*-coupling. The *tau*-value of the motoric *flee*-movement ($tau^{G}{}_{MM}$) needs to approach zero sooner than the *tau*-value of the approaching bumper car trajectory ($tau^{G}{}_{MA}$). Or with other words the gap of the motoric movement (MM) needs to be filled sooner than the gap of which the incoming bumper car is filled. The contrast with the Motoric Movement Action *catching* is situated in the fact that in catching both gaps need to be closed simultaneously ($tau^{G}{}_{MA} \approx tau^{G}{}_{MM}$). So fleeing/avoiding/not-catching is a little more complex than catching because the motoric movement (MM) must be executed (a little) sooner. However it is much more simple because of the fact that it doesn't require a strict *tau*-coupling.

The explanatory model of the Motoric Movement Action attaches great value to the Motoric Movement Action *not-catching/fleeing/avoiding* because it holds an important clue for the existence of a continuous matrix[220] in which all possible action trajectories are already there in a latent form[221]. Out of a previous formulated egocentric will we are able to deliberately *not-catch* something and also in the sport dodge ball one actively doesn't catch the ball. However most of the time the Motoric Movement Action *not-catching/fleeing/avoiding* is a reactive action which only becomes manifest if an action trajectory threatens our position or action trajectory. And like aforementioned within the reactive and latent Motoric Movement Action *not-catching/fleeing/avoiding* the movement action (MA) is equal to the movement action (MA) in deliberate catching. However the difference with deliberate catching is that we don't see a specific action trajectory yet but that we are actively looking for action trajectories that could become such an action trajectory. All objects and subjects in the environment are able to become a manifest threat at every moment. So this forms an important clue that we shape a relationship with the complete environment in action trajectories from the moment we enter a new environment. So the conclusion for the explanatory model is that every time frame we are latently fleeing in every environment. Or with other words in every environment we are actively catching all zero-moving and moving objects with the objective to not actually get them into our hands.

"In a park we also relate to the surroundings in a matrix of latent action trajectories. It doesn't appear that way but our perception processes continuously scan the complete environment. We see how we relate to the trees, the branches of the tree, the pond, the stray dog, the cyclist, the jogging athlete etc.. It is all part of our latent reactive Motoric Movement Action avoiding/fleeing/not-catching. That becomes obvious if our action trajectory is threatened by action trajectories of third parties. For example in case the storm tears of a branch from the tree right above our head, the jogger suddenly

[219] Also see *Caught In A Line*; p. 67-69.
[220] See: *Caught In A Line*; p.23.
[221] This observation aligns with the suggestions of J.J. Gibson that affordances are not created at the moment that we develop an egocentric will but that the relation animal-environment has a structural, abstracted and actual component.

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comes around the bench on a narrow road, the dog just exits the pond and starts to shake his body to get rid of the water or a bug is heading exactly in the direction of our mouth."[222]

2. The movement action (MA) of the Motoric Movement Action *catching* – The primary focus

The explanatory model appoints three parts with the movement action (MA). The cognitive basis, the tactical movement action and the actual movement action.
Within catching we use general cognitive knowledge which we stored concerning this action. People with a lot of catching experience do possess a lot of references concerning catching actions and ball trajectory shapes. They own a lot of knowledge concerning ballistics, inertia, inflexion points etc..
Within that general knowledge they for example also *precisely* know the path how a (movement) action object (tennis ball, badminton shuttle, balloon etc.) will *globally* close the gap of the related action trajectory. Besides that they possess lots of abstracted ideas about the task at hand. They know that something will come through the air, that it will come down, that we will have be to there when it comes down etc.. This all forms a huge tactical basis in which must be emphasized that it all serves the shaping of a, *precise global*, image of one specific incoming object trajectory shape.

Image: A catcher (baseball) creates a perceptual image of the latent end of the ball trajectory shape out of the manifest Initial Phase. The ball trajectory obviously doesn't come his way[223]. Then he will have to use all the time which the creation of the ball trajectory provides to create all necessary motoric movements. And so he first needs to move the glove with a running action as soon as possible. The catcher will have to do his utmost to cover the fluctuation of deviations of the action trajectory within the fluctuation possibilities of the motoric movement (MM) till the ball is caught. In this phase the catcher will have to make it possible that the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) will be able to follow the leading *tau*-value which the ball trajectory provides ($tau^{G}{}_{MA}$) and that in the final stage they equally approach zero. So in case of a remote ball in which the ball trajectory shape just provides enough time to make all necessary motoric movements all parts of the motoric movement (MM) are of

[222] *Caught In A Line*; p.24.
[223] Also see: "Watch The Ball Trajectory!"; Chapter 10.10.

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equal importance[224]. So the first initial phase, in which only a *precise global* image of the ball trajectory can be shaped, is as important as the last phase. Without the running action the later actual catch action will never be possible to happen. That is why the explanatory model concludes that the running action is as important as the actual catch action and by doing so concludes that they must be appointed more as a unity, as essentially belonging to each other in this Motoric Movement Action. That forms the basis for appointing all technique out of the unity model.

If we transfer to the actual catching than this general knowledge will be complemented with information about the actual location. The blueprint of the cognitive basis is then put on top of the actual situation. Which object needs to be caught? Over what distance? And what object trajectory shape will approach us? That forms the basis for the tactical movement action which, as aforementioned, has the goal to finally come up with one latent action trajectory shape and executes that goal by a continuous deduction process[225]. So within other words one can describe this task as limiting the number of possible (latent) action trajectories as soon as possible. In which the conclusion of a previous situation can and will be used as a blueprint, a basis, for the next situation.
So during the tactical movement action the perceptual image of possible latent action trajectory shapes will already be narrowed down drastically. However before a ball is actually thrown the perceptual image of latent ball trajectories still contains lots of possibilities which could approach us from the actual throwing place. After the ball is thrown the catcher will be able to minimize the existing blueprint with 1. information out of the motoric movement (MM) of the throw of the pitcher, and 2. the Initial Phase of the ball trajectory shape, in such a way that clear conclusions can be drawn for the motoric movement (MM). In that phase a clear, *precise global*, perceptual image can be shaped of a latent action trajectory shape.
So from the beginning of the actual movement action we are able to shape a, *precise global*, perceptual image of a latent action trajectory, a latent marble run, which precedes the ball. The ball will create the actual ball trajectory shape but will also have to follow a sound visualisation of a perceptual ball trajectory shape. The explanatory model assumes that during this process the processing processes of the perception, the ventral and dorsal stream, mutually influence each other. The ventral stream mainly observes the, latent and manifest part of the, object trajectory but in relationship to the position of the ball. The dorsal stream mainly observes the place of the ball, and the action moments that it provides, but in relationship to the ball trajectory shape. The two systems mutually audit/influence each other continuously. Every time frame the ventral stream provides information about the possible end of the object trajectory and the dorsal stream provides information about any deviations. If the ball deviates from its action path the tactical department, the cognitive basis and the tactical movement action, will immediately have to provide a new perceptual image of the latent part of the ball trajectory out of the manifest part of it. Then the ball will have to follow this new image again. This mutual process will last till the object is actually caught.

a. <u>The phases within the actual *catch* action (MA)</u>

[224] In the same way a returner to a 1st service in tennis needs to make a choice in the first, *precise global*, phase to either execute a forehand or a backhand return. If he refuses to turn to one side he will never be able to cover any future deviations of the ball trajectory optimally. So although he is absolutely not capable of predicting the exact final outcome of the ball trajectory, like the catcher in that phase, he is forced to make, *precise global*, motoric movements (MM). In cricket a player, analogous to the previous examples, will have to decide in an early phase to step in and play a push shot of the front leg when a ball is pitched *long*. To a *short* pitch he will have to decide in an early phase to play a pull shot from the back leg. So the moment he shifts his weight he doesn't know what exactly will be the outcome of the ball trajectory. But that is not the goal of it all. The goal within all these examples is to keep the optimal possibility to cover near future deviations of the action trajectory within the motoric movement (MM).
[225] It is important that you start to see that this deduction process is essential for a maximal efficient and effective, *parsimonious*, optimization process.

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In the beginning of an incoming ball trajectory the prediction of a latent trajectory shape is allowed to be global because a precise prediction isn't possible at that time but is also not necessary at that time. In that phase the action object relatively needs to travel a significant distance and so the chances to deviations are large[226]. In that phase however it is very important that a *precise global* prediction of a ball trajectory shape will be created. That becomes clear if an incoming ball trajectory shape, from any point A to a catch point B, just provides sufficient time ($\Delta t_{MA\ A\text{-}B}$) to execute all necessary motoric movements (MM), from any place C to the same catch point B ($\Delta t_{MM\ C\text{-}B}$). There is a clear division in which the catcher absolutely knows that he will never be able to intercept the ball ($\Delta t_{MA\ A\text{-}B} << \Delta t_{MM\ C\text{-}B}$). However within a certain border area ($\Delta t_{MA\ A\text{-}B} \approx \Delta t_{MM\ C\text{-}B}$) a catcher will certainly make an attempt. Therefore ball trajectories belonging to this last group must be predicted as soon as possible. It is of an essential importance that a precise global image is shaped in the earliest phase. So when a field player in baseball needs to catch such a *far* and *high* ball, when the ball moves away from him, he first needs to move the transition point (the glove) with a running action in such a way that it remains possible to align the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) within the *tau*-value of the movement action ($tau^{G}{}_{MA}$). If the field player doesn't run in that first phase than later deviations of the action trajectory can never be covered or aligned with the right motoric movements (MM). The *not-running* means then that the fluctuation of future deviations within the action trajectory cannot be covered anymore within the fluctuation possibilities of the motoric movement (MM).
So this only seems relevant for border situations and not for situations where an incoming ball trajectory provides wide fluctuation possibilities within the motoric movement (MM). That is not so. We time every Motoric Movement Action and so also every simple ball we need to catch. Although when we detect an easy incoming ball trajectory it gives us the opportunity to optimize the tactical movement action. When we are pressurized by a difficult incoming ball trajectory shape we may have to choose tactical options with a very low success rate. That is possible to occur if the catch action only can be executed with a motoric movement (MM) that leaves no more room for direct vision in the last phase of that action (for example catching behind your back, between the legs or far above the head) or if we are forced to for example to make a *jumping dive* (Boris Becker) in the last phase of the catching. Conversely within catching actions without any pressure we are able to choose those options which minimalize the error rate.
When the action object approaches us a feet position[227] must be determined[228]. The best catching position is the position which ensures continuous direct vision on the side of the ball trajectory shape. In

[226] But in spite of this fact we also know, also based on abstracted ideas of this task, for example that the object will not suddenly touch the ground.
[227] In most catching actions the determination of the feet position happens when the ball will remain in the air for quite some time. It has the same characteristics as the feet position computation within the Motoric Movement Action *letter posting*. The explanatory model shows that we take that position on basis of the known fluctuation borders of the motoric movement (MM) within the specific action. This is a major indication that we beforehand do possess cognitive knowledge and perceptual images of fluctuation borders over which length the catching hand can be moved in the last phase. The explanatory model considers this to be the only possible explanation. The practices of catching or letter posting show that on basis of cognitive knowledge of the fluctuation boarders of the length of our arm (length is a part of the action trajectory shape) we take an *easy* feet position. So if there is no need we don't stand too far of (or at a maximal arm length) or too close to the mail box. In the same way we don't catch with a maximal straightened arm or do we stand at the exact place where we want to catch the ball. Then there wouldn't be any leeway for the arm to manoeuvre. However we don't contemplate this feet position extensively. The explanatory model assumes that we quickly take any of the *easy* feet position options out of a perspective of efficiency and effectiveness. Also because we know that it is only a *precise global* determination. The actual execution of the task will only be fulfilled with on-line (bottom-up) perception processes in the last phase of the catching.
Also in here the progression of the Motoric Movement Action shows a continuous deduction process or a narrowing down process. In that way a system is able to be maximally efficient and effective but is also able to maintain a high level of accuracy in the end.
[228] In normal catch actions the body is placed somewhere rigidly to give the arm action the possibility to finish the job. However when a catcher needs to dive to a ball, he needs to define a feet position from which he will initiate that dive. This feet computation will need the same knowledge as the normal feet position determination.

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that way the shape can be observed best. In normal catch actions, towards the end phase, one will raise the *catch* hand in a general position within the scope of our direct vision. This direct vision will be maintained at the ball because at that moment the receiving is the most important task. So at that moment we will see our hand with peripheral vision with the main image of the ball in the ball trajectory. When an object approaches us within a minimal distance, one meter (?), than we transfer from mainly receiving to the actual catching with the hand[229]. That will form the apotheosis of the Motoric Movement Action because in that phase it will fulfil the essence of the egocentric formulated will. Now we are allowed to transfer the tasks because almost the whole object trajectory shape has now become manifest. The chance to deviations will now be limited drastically[230]. Although the processing processes of the perception will continue their work till the end of the Motoric Movement Action they need less attention in this phase. The priority will now transfer to the actual catching and so the perception processes clearly change their attention. The eyes in this phase will make a saccade. In the earliest phase after this saccade the catcher focusses now with direct vision at the *catch* hand. He still will focus on the two processing processes of the perception but now with peripheral vision[231]. The perceptual image of the last tiny part of the latent action trajectory will remain the blueprint for the receiving. So although the actual catching is promoted to the first priority the perception will maintain to make images of the still latent object trajectory and keeps on implementing deviations until the ball is finally caught.

There is now a very complex process going on which you are able to experience any moment by just throwing back and forth a paper wad with your colleague. The *catch* hand is now observed with direct vision but belongs to the motoric movement (MM). And the motoric movement (MM) as belonging to the secondary focus needs to be pointed at the transition point towards the action trajectory. The action trajectory is now observed with peripheral vision but the primary focus needs to stay pointed in there. This complex situation will remain till the ball almost approaches the hand. The hand will only expect very small deviations of the ball trajectory and is situated at the place where the end of the latent marble run is finally (!) visualized. From there the hand will only have to execute very small adaptations if deviations should occur[232].
So in the beginning *precise global* perceptual images will be shaped but in the end they become more and more precise. So at the end the image is very precise. Just like within a classic set marble run. This process continues until the fingers are able to close themselves around the ball and it finally will be caught.
For the greatest consistency the catcher must allow the ball to approach the hand. Therefore the motoric movement (MM) needs to achieve that the hand has a minimal or a zero velocity. These last sentences hold the essence of catching. Until the moment that you actually feel the action object into your hands (racket, bat etc.) you keep on receiving/catching and you need to let the ball come towards a visualized intersection point[233]. The situation is already very complex so there is no need for adding an extra factor of complexity by creating an extra movement trajectory. One of the major causes for mistakes is the fact that one moves the hand towards the ball in the last phase. The hand must be positioned in an easy achievable intersection point with the incoming ball trajectory. If one determined

[229] Of course the running towards the ball and all other bodily movements also belong to the actual catching but in there nothing really happens between the action trajectory and the movement trajectories. Only at the very end the motoric movement (MM) and the movement action (MA) need to come together and must try to actually take care of the fact that the ball will be caught in the transition point.
[230] The chance to deviations diminishes in an exponential way with every point P less in the action trajectory.
[231] Please observe in here the big similarities with the optimal strategy within the Motoric Movement Action *cat and mouse game* (appendix ?). It is the same optimal strategy just a small group of elite players found in sports like tennis, cricket etc..
[232] The catch action of the size of a tennis ball with one hand doesn't allow many deviations because the holding of the ball demands a specific cooperation of multiple fingers. That is why we need direct vision on the (movement) action object for a relative long time in (hold-)catching. So however combined *catch-throw* actions are far more complex actions because of the combination of two Motoric Movement Actions the catching part at a micro level is most complex in the (hold-)catching task.
[233] This for example is never noticed in tennis.

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such a position than one has to bring the hand in that area in an early phase and let it move along with the occurring deviations with the end goal to gradually move it into the direction of the definitive end point. So if a catcher needs to dive towards a ball to just make a catch possible there are two possibilities with huge differences. 1. The catcher has to make an active grabbing motion towards the ball. 2. The catcher will still be able to define a *catch* point and is able to just maneuver the hand in that position, just before the ball gets there, and let the ball come to that point. In the last option one thing will be moving, although it is just a very brief moment, and in the first option two things will move. The first option will increase the error rate with a factor[234].

b. The old-Dutch stick catching game

A magnification of this last perception phase in catching one is able to find in the old-Dutch stick catching game[235]. The eyes must be pointed at all hanging sticks. Because the eight sticks can't be covered within one direct vision image we mainly use peripheral vision in here to detect an initial phase in any of the sticks. All hanging sticks create latent action trajectories within the perception of the catcher. In this case the action trajectories are straight downward lines. Because of this all the sticks have a unique *catch* place. With the cognitive basis and the tactical movement action of this task as a starting point one is able to produce a *precise global* image of all those possible catch places. At the same time the hand will be prepared to catch a stick. Muscle tension of the hand and the hand aperture will be aligned *automatically* out of stored tactical reference images. If one stick falls then one needs to make a quick saccade to the actual catch place where one of the latent action trajectories now will become manifest. The hand is already placed in a position which provides an optimal catch opportunity due to this process.

Image: The old-Dutch stick catching game

The complexity of this catching game is situated in the fact that only at the very last moment one is able to make a *precise global* image of the end of an action trajectory. One is not able to gradually

[234] In sports like tennis, cricket etc. this catching process should be emphasized much more. Traditionally we approach these sports, like the Motoric Movement Action *cat and mouse game* (appendix E), out of the perspective of the hitting/throwing but the incoming ball trajectory is providing us the most problems.

[235] Just like the cat and mouse game this game clearly shows the reasons why the game is so complex. The explanatory model is now able to provide the full explanation of all relevant processes and besides that is able to provide the optimal strategy. Not only for these games but also for sports like cricket, tennis etc.. From now on this strategy will be available for every player and not only for the elite players who implicitly found the explanatory model because of their talent or just by coincidence.

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move the hand by ongoing confirmed perceptual information like within normal catching. Most of the time the hand will have to make a movement towards the stick because it is not in the right zone yet. An extra difficulty factor concerns the fact that the direction of the action trajectory of the stick makes a square angle with the direction of the movement trajectory of the transition point of the hand. The greatest consistency will be obtained if the catcher succeeds to let the stick come to the hand even when the hand is moving.
About the *tau*-coupling one can say that the action trajectory provides just enough time to execute the necessary motoric movements ($\Delta t_{MA} \approx \Delta t_{MM}$). Our feet are already in a position that we only need to execute arm action[236]. But that time frame is pressurized and doesn't allow to gradually let the stick come to the hand. It also shows that if we do not notice the initial phase in time that we will not be able to cover later deviations in the action trajectory within our motoric movement (MM) if we failed to make the necessary first initial motoric movements. If we don't start the motoric movement (MM) in time in this game we don't have enough time to cover the fluctuation boarders of the later object trajectory shape deviations.

c. The tau^G-value of the actual *catch* action ($tau^G{}_{MA}$)

The explanatory model doesn't make any statement about the physiological origin of the *tau*-functioning. It assumes that there is a narrow bond with the processing processes of the perception, the ventral and dorsal stream, but what exactly causes the *tau*-value must be the object of future research. But at the functional level everything can be explained now.

"Taking this notion of information further, David Lee provided a formal description of how the optical information that can be picked up from the optic flow can be used to time our actions (Lee et al.,2009). In his long-jumping study, Lee and colleagues showed how, contrary to popular belief, expert long-jumpers did not execute a rigid pre-programmed pattern of stride lengths to successfully make contact with the board. Instead, they showed how an optic variable tau, specifying the time to contact with the board, was used to regulate the length of their final strides to ensure they made contact with the board and optimised their jump length (Lee, Lishman, & Thomson, 1982). Tau, described as an optic variable in this case, is an example of an invariant property of the EAS (Gibson, 1979) that can specify the timing of an action. It has also been extended to include other sensory arrays (e.g., sound, Button & Davids, 2004) as it specifies the time to closure of any motion gap at its current closure rate (Lee, 1998). This elegant, yet parsimonious solution, suggests that there is no need for the brain to compute current distance, velocity or acceleration; instead the information needed to time our actions is directly available through the way the gap changes over time."[237]

The *tau*-value of the movement action ($tau^G{}_{MA}$) can be simply derived by comparing the manifest line segment with the perceptual image of the line segment of the whole latent action trajectory shape. The in science known statement *mind the gap* exactly expresses the feeling belonging to this phenomenon[238]. For the timing we only have to observe the closure of the gap of an incoming object trajectory. Like aforementioned experienced catchers will be assisted in this task by cognitive knowledge how for example a tennis ball, badminton shuttle or (air) balloon globally closes a gap concerning the space[239].

[236] The feet position has already been determined in an earlier phase during the tactical movement action. Like aforementioned this feet position is based on cognitive knowledge concerning the fluctuation borders of the arm length. So also in this game we stand in an easy position well within the borders of the possible fluctuations.
[237] Cathy Craig; Understanding perception and action in sport: How can virtual reality technology help?
[238] One could compare the disappearing of the gap with the one-dimensional image of the draining of the sand within the upper half of an hourglass or the filling of a glass or bottle by just looking at the *filling line*. The filling line is then the sole distinction which separates the liquid/sand from the air.
[239] The big difference with current scientific research is the fact that the leading gap within catching actions, just like in every other Motoric Movement Action, is situated in the action trajectory of the movement action (MA). And that is the line segment of the incoming ball trajectory. Current scientific research situates this gap in the

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In here I deliberately don't use the words *concerning the time* because the relevant *tau*-coupling values only will be compared concerning their relative spaces[240].

We mainly have to observe the gap of a flying incoming (movement) action object visually because we have no other connection with that object. This action object closes its own gap and we primarily must observe the closing of this gap. Most of the time this task is executed with eyesight but a nightly mosquito is also able to display a clear closing of a gap between him and your head[241]. The closure of that gap, that *tau*-value ($tau^{G}{}_{MA}$), therefore obligatory determines how the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) needs to comply and the latter will have to take care of the fact that both gaps will be closed simultaneously if you want to hit the intruder when he just arrives on your head.

3. The motoric movement (MM) of the Motoric Movement Action *catching* – The secondary focus

Although the catching technique is already a little more complex than most daily tasks demand it remains a rather simple motoric movement (MM) and because it has already been addressed in the parts above I will not appoint it any further for now. The main goal of addendum two is to clarify or to demonstrate the action trajectory shape and give more insight in the whole functioning of the movement action (MA). So in here I will mainly address the new and relevant issues concerning the aforementioned goals.
In general, within the explanatory model of the Motoric Movement Action, the primary focus needs to be pointed at the action trajectory and the secondary focus needs to be pointed at the biomechanical main action within the motoric movement (MM) towards the transition point of the action trajectory. This general description also covers the most complex Motoric Movement Actions but in lots of actions the motoric movements are so simple that we don't need to pay attention to any biomechanical main action. In these actions we don't need to pay attention to a *special* feeling towards a specific motoric movement (MM) in relationship to the transition point. Although it wouldn't hurt if we payed attention to a specific feeling. Within very complex Motoric Movement Actions (in for example a *driver stroke* in golf) or combined Motoric Movement Actions (for example catch/throw tasks like in cricket, tennis, baseball etc.) the technique is most of the time so complex that one isn't able to escape the fact that we need to focus on some part of the technique[242].
Because we need to focus a lot in every Motoric Movement Action the explanatory model makes a plea to limit the attention in the motoric movement (MM) to one aspect or feeling of the movement which is able to be representative for the whole movement[243]. The explanatory model depicts this as the biomechanical main action. But within catching, with or without a (movement) action object (net, glove, etc.), the motoric movement (MM) for most people remains so simple that they don't need any

motoric movement (MM) and observes this gap too general between the catcher and the ball. The gap within the motoric movement (MM), which obligatory must follow the leading *tau*-value of the movement action (MA), must be appointed much more specific out of the perspective of the transition point.

[240] The relative space within the gap of the motoric movement (MM) will obligatory have to follow the relative space of the gap of the movement action (MA) and must take care of the fact that they will be aligned and both finally will end at zero. In for example the very last part of a catching action the disappearing of the very last part of the gap of the ball trajectory will have to take care of the fact that at the same time all the fingers will get the signal to close themselves around the ball and to finish this Motoric Movement Action.

[241] The hitting technique (MM), in which the transition point is situated on the inside of the hand palm which will touch the outside of the head of the mosquito, towards the head of the mosquito must obligatory have to follow this audible *tau*-value. The *tau*-value, of that transition point, within the motoric movement ($tau^{G}{}_{MM}$) must be closed in alignment with the leading *tau*-value ($tau^{G}{}_{MA}$). By the way this is also an example that we are able to completely perceive the motoric movement (MM) in a proprioceptive way.

[242] It is even much worse. In 120 years of tennis development they are still so occupied with this (secondary) focus that the primary focus hasn't been discovered yet.

[243] That is not always possible. In the Motoric Movement Action *swimming* athletes normally need to secondary focus out of two perspectives. One out of the arm action and one out of the leg action. But hopefully they are able to focus on one specific part or movement within both actions. See also *Caught In A Line*; The Motoric Movement Action *swimming*; p. 74.

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attention to the biomechanical main action of the catching technique. The (possible leg and) arm action is simple and forms a part of motoric actions which we execute many times every day. So within the motoric movement (MM) of the Motoric Movement Action *catching* we don't focus on any biomechanical main action but we only focus *secondarily* towards the transition point in the direction of the action trajectory.

a. The transition point within the Motoric Movement Action *catching*

The formula MMA = MM x (MA) shows that the Motoric Movement Action contains two autonomous parts. That is correct. But they always share one common point and that is called the transition point. The actual transition point in catch actions is only produced in the final part of the catching and that relates to the space between 1. the outside of those body parts that will actually touch the (movement) action object (ball, shuttle, balloon etc.) and 2. the outside of the (movement) action object that actually will be touched. So when an action object is finally caught there is one transition point. However if one wants to appoint the phases of the transition point before the final catching there are two perspectives to consider. The transition point can be appointed out of the perspective of the outside of the ball that will be touched or the transition point can be appointed out of the perspective of the parts of the hand that will finally touch the ball[244]. In here I will address this last perspective. It is of great importance to be able to understand the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$).
When a catcher wants to catch a *high* and *far* ball (kind of tennis ball) with one hand he will need to move the transition point on the inside of his *catch* hand over a huge distance[245]. At every moment in time the transition point will show a different place $P^{t}(x)$.
All points P^{t} of the linked transition points will now also shape a line trajectory from a random starting point to the actual catching point[246]. This line segment of transition points has exactly the same character as an action trajectory. Experienced catchers possess, have developed, a *precise global* image of the transition point trajectory shape[247] due to extensive training. The big difference however is the fact that we are not able to influence the action trajectory but that we are able to bodily influence the transition point trajectory. We mainly influence this trajectory in a proprioceptive way. Experienced catchers feel exactly over which line shape the transition point moves and in essence they don't need any eyesight in this task. However in (*hold-*)catching we need actual eyesight on the action trajectory for a relative long time because the fluctuation borders of the motoric movement (MM) don't allow much deviation from the action trajectory if we at the end really want to hold the ball in our hand. Because of this we are also used to visually observe the last phase of the motoric *catch* movement (MM).

b. The tau^{G}-value of the motoric *catch* movement ($tau^{G}{}_{MM}$)

[244] It is very important to understand that the gap of the motoric movement ($tau^{G}{}_{MM}$) is actually situated between these two perspectives. The way in which the two transition point perspectives approach each other is the exact way how this *tau*-value of the motoric movement is created.
[245] Obviously in that process a running and an arm action can be noticed. At a micro level that seems a big distinction. However at a macro level they both have only one common goal. Namely to just close the gap between the catch hand and the ball. Like mentioned in addendum 2 the abstract notion that goes along with that process is that the *nothing* between the two transition point perspectives just needs to be bridged.
[246] The determination that the transition points are *caught in a line* as well will have to make an end to the current ideas in scientific research that motoric movements must be appointed out of egocentric parameters, coordinates etc.. Although the explanatory model appoints most things more complex this aspect is appointed much more simple. And in that way it legitimises the ecological approach much more.
[247] Elite players need that image because they tactically need to create a latent intersection point (the *catch* point), of the (latent) action trajectory and the (latent) transition point trajectory, which they are able to execute within the motoric movement (MM). One can't fulfil this task without images of precise global shapes. Then you will never be able to create a latent intersection point. An aforementioned condition in that tactical task is the fact that the intersection point will have to afford that the execution of the motoric movement (MM) towards the catch point needs less time than the (movement) action object (the ball) needs time to arrive in that catch point ($\Delta t\ MM < \Delta t\ MA$).

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Because we are also able to visualize the motoric *catch* movement (MM) over a not-visible *marble run*, with in this case the transition point out of the perspective of the hand as the marble, we are able to establish a gap between the manifest part of the line segment and the (latent) end point (the catch point) of that transition point trajectory shape in the exact same way. Like aforementioned within the action trajectory we don't need complex computations to observe that gap but we can simply observe the closing of a line segment in a one-dimensional way.
You are able to exactly observe the disappearing of this gap in a proprioceptive way by clapping behind your back. It will show that in each phase we possess a precise global image of the gap between the two hands without any direct vision. The tau^{G} or tau^{Gap} of the motoric movement (MM) can be specified to $tau^{G}{}_{Mb.}$

With the aforementioned observations I will now have to appoint a number of fallacies in current scientific thinking. The explanatory model agrees that there is a gap between the catcher and the ball (Lee, Craig etc.) but 1. it is not the leading gap, 2. it is not the same gap like in the long jump (Lee et al.) and 3. it needs to be specified much more out of the perspective of the transition point. The leading gap is the gap of the action trajectory ($tau^{G}{}_{MA}$). And that indeed is the appointed gap in the long jump but is absolutely not the line shape from the catcher to the ball. The leading gap is situated in the incoming ball trajectory shape.

c. <u>The fluctuation boarders of the motoric *catch* movement (MM)</u>

In here I will appoint catch actions with a solid (movement) action object which show a great horizontal component in the incoming object trajectory. So I leave objects like sugar, rain or even a ball falling right out of the sky out of this reflection. The catching of these *vertical* falling objects can be executed by shaping a bowl with your hand palm[248]. The fluctuation borders are so different in there that I want to leave them out of this explanation for now.

Images: Left – (*Hold*-)catching of mainly horizontal incoming object trajectories with one hand can only occur by counter-pressure of at least two fingers. Middle – The fluctuation borders of one hand would relatively be big if the action object only needed to be touched. But these fluctuation borders are strongly reduced because the relevant fingers need to be closed precisely around the ball[249]. Right

[248] Juggling with three balls with no eyesight (https://www.youtube.com/watch?v=QiUM64TfKHQ) is very well possible because the balls only need to be caught vertically and the hands are able to form a kind of bowl. It cannot be executed but if a juggler had to catch the balls horizontally with the here outlined precise catch and finger timing that task would become impossible. The *blind* juggling can now be executed because an experienced juggler is able to precisely estimate and to remember the deviation of just three outgoing ball trajectories. In which there needs to be remarked that the involved action trajectories are very short so deviations will hardly have any chance to occur. And the very small deviations that will occur will be covered easily within the fluctuation possibilities provided by the *bowls* of the hand palms. If those small deviations required precise 1:1 timing and closure of the fingers than instantly the task of blind juggling would become impossible and even the task with normal eyesight would get much more complex.
[249] In here one could make associations with the fluctuation borders of the thread and needle task or the key that almost has to fit into the lock 1:1.

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– The catching of a bigger ball with two hands is a much less complex task because the fluctuation borders within the motoric movement (MM), in many constellations of the hand palms, can handle much more deviations of the action trajectory. The catching in here doesn't depend on the exact timing of the closing of the relevant fingers. The ball speed for example can first be reduced by one hand and by doing so it will take care of the fact that the, heavier, ball sticks a while to that one hand. So the other hand doesn't need to give counter-pressure right away.

Now with the explanatory model every Motoric Movement Action can be sorted for its complexity. In addendum two I will review tennis versus cricket for that matter. To better understand that part I will now address the sole (*hold*) catch task versus the combined (*not-hold*) catch and throw task which tennis and cricket requires. If you only compare the catching than the sole catch task of a ball with one hand is much more complex. The fact that you have to hold the ball in the final stage plays a key role in there. Because the fluctuation borders within the catch hand are very limited. The catching and the successive holding of the ball not only demands that the surface of the hand will have to touch the ball but also that a certain counter-pressure of certain surfaces within the hand will be created. Within only the palm of the hand this can only be realised in a very limited way and usually will be executed by the counter-pressure of at least two fingers. However the catching of a size tennis, baseball, cricket ball will usually be realised by three to five fingers. In the very last phase when the actual catch will occur these fingers will have to be closed around the ball almost 1:1. This action requires excellent timing and so the functional *tau*-coupling is of crucial importance in there. The closing of the last part of the gap within the ball trajectory ($tau^{G}{}_{MA}$) will have to be observed closely and will have to give the exact cues to the motoric movement (MM) to close the fingers exactly when this *tau*-value approaches zero. If the motoric movement (MM) fires too soon the ball bounces against closed fingertips. If the motoric movement (MM) fires a little too late the ball will bounce against the hand palm as like it bounces against a wall and you will be too late with the *holding* part of the catch action.

4. The complete Motoric Movement Action *catching*

The description of the two only organs of the Motoric Movement Action can leave the suggestion that they are linear or otherwise separated processes. That is a misconception. Both organs are part of one undivided complex system. The explanatory model explains the Motoric Movement Action as a complex system. The description of the motoric movement (MM) and the movement action (MA) only concerns the explanation of the two complex subsystems. During the execution of a Motoric Movement Action they need to be executed simultaneously. The explanatory model explains that perception processes are needed in both parts and out of which perspective they need to be perceived. The explanatory model is connecting the processing processes of the visual perception to the movement action (MA) and proprioceptive perception to the motoric movement (MM) but it doesn't exclude that some perception processes show overlaps.
So in catching the primary focus must be pointed at the incoming ball trajectory shape and at the same time the secondary focus must be pointed at the biomechanical main action towards the transition point of that action trajectory.

a. The *tau*-coupling within the complete Motoric Movement Action *catching*

If one is able to appoint the *tau*-value of the movement action ($tau^{G}{}_{MA}$) and the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) then the functional *tau*-coupling is just an easy enterprise. The leading *tau*-value is the $tau^{G}{}_{MA}$ because it will fulfil the essence of the Motoric Movement Action and because we are not able to influence it. The $tau^{G}{}_{MM}$ will then have to follow the $tau^{G}{}_{MA}$ because it executes the movement action and we are able to influence it. So when a ball approaches us we first determine, a *precise global* image, of a possible catch point[250] and then we mainly observe how the ball fills the

[250] During the initial phase of the ball trajectory shape the tactical movement action provides a *precise global* image of a catch point. That point is one of the intersection points of the ball trajectory and the transition point line out of the perspective of the hand. It is essential that you start to see that two *precise global* perceptual images of latent line shapes create that intersection point and that deviations are expected to occur and are expected

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gap to that point. That will dominate the process of the motoric movement (MM). So while we let the ball come to the designated catch point we try to close the gap from our hand to that same point in an equal way.
If one would describe the *tau*-coupling in short then one could say that the closing of the gap of the action trajectory must be aligned by the gap within the motoric movement (MM) and that they both must be fully closed at around the same time[251]. As an extra condition one needs to add in here that the gaps must finally end up in the same (catch)point. You can close all the gaps you want but if that doesn't happen in the same end point then that is useless. So as an addition one has to say that the gap of an incoming ball trajectory shape from a random point A to a catchpoint B must be aligned with the gap of the motoric movement (MM) from a random point C to the same catchpoint B ($tau^{G}{}_{MA}$ A→B ≈ $tau^{G}{}_{MM}$ C→B).
These are the only two *tau*-values which are connected to the *tau*-coupling within the functional execution of all Motoric Movement Actions. Although people don't realize it and although science couldn't discover them both these *tau*-values are executed implicitly by all good catchers. In science many other *tau*-values[252] are appointed but they have no influence[253] during the functional execution.
The functional *tau*-coupling shows within the coupling the exact same relationship as the relationship which can be seen between the primary focus and the secondary focus.

5. The dualism within the linked Motoric Movement Actions *catching* and *throwing*

In here I will briefly appoint the dualism which occurs during the processes within linked Motoric Movement Actions *catching* and *throwing.* It is mentioned a lot in addendum 2 and in general these combined actions take a special position. Till now one hardly has not acknowledged that the catch and throw task in various ball sports comprises two totally different Motoric Movement Actions with two totally different tasks. Historically we only focus, in a naïve way, on the *sending* process in these sports. And so from our earliest childhood we are mainly *hitting* badminton shuttles at camping sites, soft balls at the primary school playground, baseball balls at the sport field at secondary/high school and melons[254] when the Dutch celebrate the birthday of their king because that is the obvious identifiable action when we look at elite players. But the truth is that, at least for a long time, we are mainly not-hitting or missing the objects because we are not able to see all the essential processes within these tasks.
The essential processes which we are not able to see are related to the linking of two action trajectories of two actions. The receiving is concerned about the line shape of the incoming ball trajectory and the sending is concerned about the line shape of the outgoing ball trajectory. The essence in there is the

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to be corrected during the actual execution. It is part of an optimal optimization process. We will not be able to execute catch actions without this rough sketch. But although it leads the whole action it will never be able to execute a Motoric Movement Action successfully. Therefore you need to observe the actual deviations within these *precise global* predictions.

[251] However if one would describe the process into more detail then the perception processes within the movement action (MA) mainly follow the *shape* of the action trajectory. The closing of the gap, which is only a component of the timing, is just an easy one-dimensional linear part within that process. The shape contains many more dimensions. The shape of the incoming ball trajectory will have to be responded with a precise fitting shape of the motoric movement (MM). So the determining of a *tau*-value towards the functional *tau*-coupling is a lot simpler.

[252] For example D.N. Lee appoints many different values of *tau*.

[253] In daily road traffic the other road users also produce tau^{G}-values. They continuously close their own gaps within their own Motoric Movement Actions. But the perceiving of those gaps provides no information for the actual movement action of your own Motoric Movement Action *moving A-B*. Your own actual movement action only has to cope with your own *tau*-coupling in which $tau^{G}{}_{MA} \approx tau^{G}{}_{MM}$. The gaps of the other road users (A, B, C, etc.) only need to be assessed marginally within the tactical movement action and that will have to take care of the fact that no action trajectory will be executed at the exact same time at the exact same place ($tau^{G}{}_{MA\ own} \neq tau^{G}{}_{MA\ A,\ B,\ C\ etc.}$). You can compare this to the situation when 20 students toss their own hat during the graduation ceremony and want to catch their own hat.

[254] See appendix E; The Motoric Movement Action *cat and mouse game*.

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fact that within the movement action (MA) the line segment of the incoming ball trajectory needs to be lengthened with a line segment of an outgoing ball trajectory. The exact end point of the incoming ball trajectory must be used as the starting point of the outgoing ball trajectory shape. In sports like tennis, cricket, baseball, volleyball[255] etc. a direct linking to a (mini) chain[256] is obligatory. So however the task in aforementioned sports is regarded as one and undivided the linking will always be part of two Motoric Movement Actions which are optimized by significant different components.
The dualism of the task is situated in that optimization process. Optimal catching, as aforementioned, benefits from the fact that 1. the catching hand will remain as stable/static as possible[257] during the actual catch action and 2. that a catcher let the ball come to the *catch* hand. The latter will become perfectly clear if one is not able to achieve the static hand position mentioned under point 1 and one needs to make a movement to the ball with the hand. Then it makes a huge difference if one actively needs to move the hand towards the ball or if one is able to choose a, *moving*, catch point from where the catcher can allow the ball to come to the hand. This last option optimises the receiving part of this Motoric Movement Action best and that's why it is part of elite player's gameplay. The explanatory model assumes that the error rate is influenced with a factor in a positive way when a player approaches catch actions with this attitude.
Optimal sending[258] benefits from a sending phase which corresponds as much as possible with the Initial Phase of an outgoing ball trajectory shape. Optimization in that process also occurs by the transferring of as much energy as possible in the transition point/contact point. Especially in the current era of *power* sports. Therefore the transition point first needs to be moved away far from the possible intersection point of the two relevant incoming and outgoing line segments and then needs to be taken back to that intersection point as fast as possible.
So there is a clear dualism between optimal catching and optimal sending and that can only be solved by an optimization process. In there one could say that in brief it comes down to emphasize that process that experiences most pressure. If you must hit an incoming balloon into a rather remote goal then the receiving process will provide so much time that you are allowed to really emphasize the sending process and hit the balloon in the outgoing *balloon* trajectory. If you have to return a tennis service of Karlovic or Raonic then the best thing for you is to spend all your attention to the receiving of the incoming ball trajectory shape because you will probably not be able to even touch the ball in that process.

By revealing the whole complexity of all Motoric Movement Actions it is nice to see that one is able to explain the evolution of sports and games and their game rules. In volleyball for example one has acknowledged the aforementioned dualism and manifested it in two separate components. In volleyball, like tennis, table tennis, badminton etc. one needs to create chains of ball trajectories.
But in volleyball it is not obligatory to lengthen the chain with a ball trajectory directly to the opponent but one is allowed to create two ball trajectories to their own team mates first. This makes it possible that one is able to completely focus on the receiving process when the opponents produce their final ball trajectory because only a neutral outgoing ball trajectory needs to be produced. Because the incoming ball trajectory will contain a lot of energy[259] everything can be focused on letting the ball come to the hands in which only the ball speed needs to be absorbed in a certain way. Next the *playmaker* is able to link the ball to the last player as easy as possible to the last player. This last player then has the goal to lengthen the chain of ball trajectories with an outgoing ball trajectory shape with

[255] In team sports the Game Idea also revolves about making chains. The Game Idea comprises two elements. 1. Both teams must try to make a chain of ball trajectories of which the last ball trajectory must end up in a goal area. 2. Both teams must try to keep the opponent from fulfilling the first task. In most team sports however you are able to create ball trajectories to yourself.
[256] The explanatory model defines multiple linked ball trajectories as a *chain*. The linking of one ball trajectory to just one other trajectory can be defined as one cycle (within a chain).
[257] The complexity of Motoric Movement Actions increases with a factor the more things are moving. The ball will always move. So we can't influence that part. But if we are able to hardly let the hand move we did our utmost to simplify the action. When two things are moving, you need to pay attention to them both, the *tau*-coupling gets more complex etc..
[258] See for more information the Motoric Movement Action *throwing*; *Caught In A Line*; p. ?.
[259] See also "Watch The Ball Trajectory!"; The dualism in ball trajectories; p.

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an optimal game intention[260]. So in this last task the emphasis clearly shifted to the sending process. In there it is not only the task for the playmaker to create one easy receiving process but even to create multiple options which will provide multiple contact points.
However this division, like in volleyball, is very rare[261]. In most sports one first needs to maximally/optimally receive the ball and directly link that to a maximally/optimally sending of that ball[262]. Especially that last task holds the essence of it all. So the difficulty within these tasks is to combine the receiving to an outgoing ball trajectory shape with an optimal game intention. And therefore all sports are characterized by a difficult catching task because otherwise they wouldn't be a sport[263]. And that is why the acknowledgement of this dualism and the formulation of an optimal strategy to it is very important in raising elite players. The basis of the optimal strategy is appointed in the Motoric Movement Action *cat and mouse game.* This strategy explains exactly how elite players in several sports have adapted to the aforementioned complexities.

[260] Ball trajectory shapes, game intentions and success rates show a set relationship.
[261] In many sports they just decided to ban the receiving phase completely.
[262] I am able to quickly learn an elite player to return a first service of Karlovic or Raonic with a high success rate. But to return the ball in such a way that a reasonable chance will occur to also win the point is a completely different issue. The returning of a service is meaningless if the server will 100% score every return.
[263] If the pitcher would be wiling to deliver nice and easy slow paced incoming ball trajectories we would all be able to hit homeruns.

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Appendix C – The Motoric Movement Action *letter posting*

1. Introduction

The task within the Motoric Movement Action *letter posting* is to get/throw a letter, and only the letter, into a mailbox. So this part of the task is formulated out of an egocentric will but in essence this specific part will only be executed by the letter[264]. With all of its consecutive places P only the letter will construct the action trajectory shape. Just like a ball in every ball sport, the ink during the Motoric Movement Action *writing*, the food during the Motoric Movement Action *eating*, the outside of a fingertip[265] within the Motoric Movement Action *grabbing/taking/touching* etc. the letter is a fully autonomous entity. We don't share anything with the letter, we are not the letter and we will never have something with it. We are going to post a letter due to an egocentric will but the movement action (MA) remains something of the (movement) action object and not of the ego. The movement action (MA), conform Gibson, expresses the relationship *between* (!) the animal and the environment and has nothing to do with the execution of the action by the animal itself.

We never posted a letter and we never will post a letter. The letter posts itself. We are only able to execute the letter posting.

However the letter will not do anything by itself. Without a letter we are not able to fulfil a posting task but if we don't pick up the letter nothing will ever disappear in a mailbox either. Just like within all Motoric Movement Actions we will have to move the motionless, dead, letter outside our body with movement trajectories within our body which we do control. Therefore letter posting can only be executed if we simultaneously keep the primary focus on the essence of the task, the letter trajectory shape, and keep the secondary focus on those movement trajectories that will execute the posting towards that primary focus. Probably you will find that hard to understand because we automated the posting process completely. The action trajectory of the letter is simple and we are able to control it every moment in time within the movement action (MA) because we hold on to the letter constantly till the moment we actually deliver the letter with a little throwing motion. Besides that the motoric movement (MM) is very simple as well. In letter posting we have combined the two foci to one, very familiar, complex focus image so that it seems that we execute this task 1:1. But that is not so. We are only able to move the letter over a line segment shape outside of our body by creating very awkward movement trajectories within our body. These lines/trajectories don't even have anything in common when it comes down to the line shape[266].

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[264] It is like the water in a mountain stream. Only by moving rocks we are able to influence the direction of the water.

[265] See: Appendix D: The Motoric Movement Action *grabbing/taking/touching*. Of course the outside of our fingertip belongs to our body but we are only able to move that outside part over a line segment shape by the means of movement trajectories within our body.

[266] If the body really would execute tasks 1:1 then it is almost impossible to think about the consequences. Then the body must be equipped to create all the countless possibilities of action trajectory shapes separately. We then probably need to own hundreds of extra muscle groups. That is unworkable and it seems much more logic that

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The script within the Motoric Movement Action *letter posting* contains two actions. The first one relates to the Motoric Movement Action *grabbing/taking*[267] etc. of the letter. I pick up a letter with the help of three fingertips and hold on to it by creating a counter-pressure between on the one side the thumb and on the other side the index and the middle finger[268]. So before I actually pick up the letter I create a perceptual image of a latent action trajectory shape out of the perspective of these fingertips towards the places of the letter that will be touched by these fingers. The moment I feel the letter into my hand the Motoric Movement Action *grabbing etc.* is finished and the Motoric Movement Action *letter posting* begins. So this Motoric Movement Action arises at the writing desk at home where I just grabbed the letter.
So at a macro level all the places P of a letter from the writing desk to the slit of a mailbox create the action trajectory shape. However in general, at a micro level, one can divide the Motoric Movement Action *letter posting* into three parts. 1. The movement towards the mailbox with in my case a lot of leg action. 2. The standing in front of the mailbox with in my case a lot of arm action. 3. The tiny throw of the letter into the mailbox in the very last phase of the posting. However we don't consider the walking towards a mailbox as a part of the post action. The letter is hanging passively[269] to the side of the body and we are mainly occupied with the Motoric Movement Action *moving A-B*. The cause of this is that we cognitively know that the letter[270] will automatically travel with us during our movement as long as we hold on to it. So when we arrive in B we know that the letter will be there as well. For our feeling the Motoric Movement Action *letter posting* just starts when we arrive in front of the mailbox. Although the letter remains passive, like in all the parts, we now experience a *moving* letter. But the only difference now is that the letter is mainly moved by arm action instead of leg action. It is important to notice in here that the arm and leg action only have one common goal. Namely to move a motionless, dead, object over a line segment shape. And that line has the only goal to just bring the letter closer to the slit of the mailbox through the *nothing*[271]. When the letter is secured into the slit of the mailbox the Motoric Movement Action *letter posting* will be finalized with a very tiny throw. In throwing actions one is only able to influence the initial phase of an object trajectory[272]. One needs to construct the whole object trajectory during that very first beginning. However within the Motoric Movement Action *letter posting* every spot in the receptacle of the mailbox will lead to a successful delivery and that is why every throw of a letter which is secured into the slit of the mailbox leads to a 100% success rate. Even in this phase the letter remains a motionless, dead, object. I establish the actual throw by transferring an impulse in the transition point with the help of a minor wrist action. The letter will be able to travel the last part of the action trajectory by itself because all the fingertips will be released from the letter at exactly the same moment due to a precise *tau*-coupling[273]. In this last phase of the letter posting task an impulse needs to be transferred from the body to the letter. Just like

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the body chose for the cooperation of two autonomous, generic, systems. In which one system completely focusses on the (movement) action object (the letter) and monitors the consequences as well as the goal of the movement action (MA) and the other system completely focusses on the execution of that movement action (MA) with the help of just *a limited supply of general* muscle groups within the motoric movement (MM). In that way the body chose for a splendour of a solution. Due to the complex cooperation of both complex subsystems a multitude of egocentric formulated tasks can be executed. This complex cooperation is indeed complex and therefore harder to understand but the autonomous parts function in a relative simple way with the effect that they quickly achieve and efficient and effective optimization within the possibilities. It is exactly what one would expect within a sensible, *parsimonious*, developed body out of an ecological approach and it is completely in line with the development of other organ systems.

[267] See: Appendix D: The Motoric Movement Action *grabbing/taking/touching*.

[268] In appendix D the grabbing of a little coffee cup is appointed out of the exact same (movement) action objects.

[269] The letter will be passive during the execution of all three parts.

[270] A letter is such a solid object (and not for example a liquid or a soft bread dough) that we know that if we hold a part of the letter that the rest of the letter will come along.

[271] This is one of the essential abstract ideas we constructed within this task.

[272] See the Motoric Movement Action *throwing*; *Caught In A Line*; p. 63.

[273] See here below under point 4.a.

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in for example darts. Therefore the (movement) action object, the letter or a dart, must be held over a precise action trajectory shape but must also be released by *all fingertips simultaneously* (!) at an exact point to be able to execute an independent trajectory. So this seemingly very simple task is in reality a very complex process in which the *tau*-coupling plays a huge role.

When we are sitting in a comfortable chair we are able to create a cognitive image of the task in every Motoric Movement Action. So we are also able to do that in a letter posting task. We are very familiar with the task and in our mind we are able to see ourselves execute it. We are able to visualize that at our *own* mailbox but we are also able to visualize it as a general action at every kind of mailbox. We are able to construct lots of abstract images within this task. You know that you will have to deliver something. That you will have to get the letter parallel to some kind of insertion possibility. That the insertion possibility must be situated at an elevated position in order to let a letter drop into a *lower situated* receptacle. That you will have to make a small throwing motion in the end. Etc. etc.[274].



If we are actually going to execute a posting task at a *new* mailbox then we first make a tactical plan with the aforementioned cognitive basis as a reference. The final goal of that tactical plan is to construct a perceptual image of a latent, *precise global*, line shape from the letter in the hand towards the slit of the specific mailbox before the actual execution will start.
During the actual execution we just execute the tactical plan. We bring our hand, or better, we bring the letter in the beginning of the perceptually shaped latent trajectory which will lead to a successful execution and just follow the plan. So we *throw* the letter in the beginning of the letter trajectory from which the letter is not able to escape. Within the actual execution of the movement action (MA) mainly visual perception processes are at work. They are processed in two streams. The ventral and the dorsal stream[275]. The ventral stream mainly observes the action trajectory shape. The actual position of the letter is noticed but the emphasis is placed on the action trajectory. The dorsal stream mainly observes the actual position of the letter. In here the action trajectory shape is noticed as well but the emphasis is now placed on the letter. These processing processes of the perception audit each other in a continuous mutual relationship in which the actual place of the letter will provide the actual action moments. If the letter deviates from its *action path* a new perceptual image of a latent action trajectory shape must and will be created right away. The letter will then have to follow this shape again and will then be audited again by the dorsal stream. This will continue till the letter reaches the slit of the mailbox.

Now most mailboxes are solidly attached to the ground and so most motoric *post* actions won't need a lot of corrections. But let's try to imagine that you are in another country and the mailbox is stably

[274] This is a very limited description of all the abstractions we gain during years of posting experience. More abstractions and abstractions about the *nothing* will be appointed later when the patient D.F. is discussed.
[275] https://en.wikipedia.org/wiki/Two-streams_hypothesis

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moving horizontally side to side over a length of 50 centimetres. Than you will witness this mutual process much better.
The cognitive basis has not changed. When you arrive at this mailbox you conduct a quick research and again you make a tactical plan based on the actual environment information. From your *feet position* you are able to reach the slit of the mailbox within your arm's length[276]. The difference with the stationary mailbox is that the perception now constructed more perceptual images of possible action trajectories. A global image of latent action trajectories. Because you can't make a precise latent action trajectory yet and at this moment there is no need for such a precise action trajectory. The only need, and that is very important to understand in lots of Motoric Movement Actions, is that the letter first will come closer to the slit[277] of the mailbox.
After you made a tactical plan you are really going to execute the actual *post* action. Now it would be nice if you would really join me in this action at this point. With the global image of latent action trajectories in mind you bring the letter up to the slit. The main goal remains to get the letter closer to the slit. The two processing streams are more active now. The ventral stream shows changing action trajectories every new time unit which you try to follow for a bit as a global leading guide. The dorsal stream is now correcting more actively.
Still you manage to get the letter closer to the slit. The perceptual latent action trajectory is now actually manifest for most of its part. There is just a little part of the latent action trajectory left. The more an action trajectory is actually completed the more the chance to deviations will diminish. It diminishes exponentially. So in this last phase the actual *post* action can therefore change the emphasis from bringing the letter closer to the slit to actually inserting the letter into the slit although the processing processes of the visual perception will maintain to do their job like aforementioned. They will keep processing till the task is fully completed.
In the mean time you brought the letter in your hand parallel to the slit. This will lead to posting this letter as well. Although you wonder if you will ever come back at such a mailbox again.

2. The movement action (MA) of the Motoric Movement Action *letter posting* – The primary focus

The explanatory model of the Motoric Movement Action appoints three parts within the movement action (MA). The cognitive basis, the tactical movement action and the actual movement action.

In letter posting we possess an incredible huge basis of general knowledge concerning action trajectory shapes which we are able to create with the arm. We experience all Motoric Movement Actions we execute in line segment shapes[278] and so all these shapes become references for all future actions. They will form the future blueprints for all other action trajectory shapes. As aforementioned we possess a lot of abstract images within the posting task. For example we do possess *precise global* images about the length of the action trajectory and also a *precise global* image about the involved execution time of an action trajectory[279]. Because we are able to hold on to the letter in the first two phases of the posting process we are able to influence the time of execution at any point. So the timing is not relevant during the usual execution of a posting task but even so we do create a *precise global* time frame

[276] Or to put it stronger. You will have tactically assessed the situation in such a way that you are able to execute most action trajectory shapes within that feet position. This is based on cognitive knowledge concerning the maximal length of action trajectory shapes.
[277] So at a micro level the main goal in here has nothing to do with the later insertion but solely has to do with the bringing together of two items in which the crossing of the void between the animal and the environment is the essence and not the egocentric formulated goal. Within there it is very important to understand that this bringing together always is achieved by bridging a gap with *nothing*. Because a letter or any other item can only be *posted* if in the whole action trajectory *nothing* will block its way. That is why our visual perception processes actively look to create a path where there is *nothing*. This goal is never noticed because, indeed, *nothing* is there to be seen.
[278] All Motoric Movement Actions are *Caught In A Line*.
[279] A time image and a specific length are all part of the action trajectory defining factors. Also see "Watch The Ball Trajectory!"; The ball trajectory defining factors (BTDF); p. 27.

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within this execution. This timing process will become clear if we are going to post a letter while riding on a bike. Then only a short distance A-B in front of the mailbox will be available in which successful action trajectories can be created towards the mailbox. That distance A-B will then provide the fluctuation borders of the time span (Δt) in which the action trajectory must be created. If the time, in which the cyclist is between A and B, is shorter than the timeframe an action trajectory requires to be executed then the action trajectory can never be executed successfully ($\Delta t_{(A-B)} < \Delta t_{(action\ trajectory)}$). So if you want to post a letter riding on a bike you will have to slow down your velocity in such a way that you are able to create one whole action trajectory within the time fluctuations of your presence in front of the mailbox ($\Delta t_{(A-B)} > \Delta t_{(action\ trajectory)}$).

The appointing of the fluctuations in the previous description are an important step to the next example of the *feet position* determination in front of the mailbox[280]. I will appoint this determination now but I want to stress in here that this description will later be the stepping stone for the upcoming appointing of the functioning of the *visuo*-motoric processes within the movement action (MA).

The description of the feet position determination[281] in letter posting is a crucial indication of the existence of perceptual images of latent action trajectories. Besides that it will finally show a big part of how it all really works. The explanatory model shows in a very clear way that we determine a feet position in front of the mailbox based on cognitive knowledge about the *precise global* (fluctuation) borders of the possible lengths of all action trajectories we are able to execute with an arm. If we were only able to execute this with the help of online perception processes then a feet position could only be determined *during* the execution of the actual *post* action. That is obvious not the case. We very well know the global borders of the length of an action trajectory shape with the arm before we are going to actually execute the task. This knowledge about the fluctuation borders of the length of these action trajectories is an important part of our cognitive basis.

Images: The fluctuation borders of the length of the arm action are an important part of our cognitive knowledge concerning an action. We are able to increase the maximum length with the help of special[282] techniques (photo left) but above a certain value we just know that we are not able to bridge the gap. Even if there is hardly no room to manoeuvre, because of safety reasons or crowdedness, then we still are able to use that minimal distance to execute the necessary actions (photo right). But also when this value drops under a certain value then there will be no manoeuvring room left. So if you get squeezed against the door of the fridge then there is just no room to reach the hand grip.

The explanatory model of the Motoric Movement Action provides a clear, logical and uniform explanation for all feet position determinations. In all the decades I posted letters nothing ever inhibited the

[280] This feet position determination can be applied to many Motoric Movement Actions.
[281] The feet position determination marks the transition between the leg action in the first phase to the stand still and the arm action in the second phase of the Motoric Movement Action *letter posting*.
[282] The so called *finger walking*.

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action and I was able to use the whole spectrum of action trajectory shapes and I think that is your main experience as well. If we are able to post *freely* then the explanatory model assumes that we quickly choose a position about halfway the fluctuation borders of the arm concerning the length of the action trajectory shape. So we don't stand too close to the mailbox and we don't take a position at our maximum's arm length either. We choose a comfortable, *easy*, position which doesn't require any extreme arm action. But as aforementioned we occupy the first available *easy* position very quickly and don't have a lot of extensive considerations in this process. We then know that this position will comfortably cover any possible, *sudden*, deviations/disturbances quite easily and we leave the actual execution to the online perception processes which will have to finish the actual action. This all points to an efficient and effective, *parsimonious*, system that in the preliminary phases only tries to come to a strong, *precise global*, reduction of all possible action trajectories within a very limited amount of time.
Out of the aforementioned you are also able to deduce that the perception processes in a posting task not just start after the feet position determination. The explanation of this determination involves the leg action much more into the posting task and shows that it is just the transition phase of the movement of the motionless, *dead*, letter by mainly leg action to movement by mainly arm action.

At a specific mailbox location the general cognitive image of an action is transferred to a very restricted action trajectory shape due to the tactical movement action. This shape will serve as the basis for the actual movement action and in fact is a perceptual image of a latent action trajectory shape. An action trajectory which can be compared with an invisible marble run. The aforementioned advantage of this *open* marble run is the fact that the letter is not obliged to follow one set pathway but that it is able to adjust itself to any possible, *sudden*, obstruction which could hamper a successful delivery. However the aforementioned downside of this *open* action trajectory is the fact that possible deviations need to be monitored continuously. As aforementioned this monitoring process is attributed to the processing processes of the perception, the ventral and dorsal stream. The ventral stream is mainly occupied with the action trajectory but in a set relationship to the actual position of the letter. The dorsal stream is mainly occupied with the actual position of the letter but also in a set relationship with the action trajectory. This definitely ends the *perception-action* dichotomy and leads us to the conclusion that the actual *posting* action can only be executed by a very clear and essential cooperation of *cognitive-perceptual* shaped images and *actual online* perception processes[283].

a. The *tau*-value within the movement action ($tau^{G}{}_{MA}$)

Only if one will realize that both types of perception processes are simultaneously needed in the Motoric Movement Action *letter posting* only then one will be able to gain insight in how the *tau*-value of the movement action ($tau^{G}{}_{MA}$) can be specified. The *tau*-value of the action trajectory within the movement action ($tau^{G}{}_{MA}$) can only be determined by observing how the manifest part of the *letter* trajectory closes the perceptual image of the latent part of that *letter* trajectory. For the *tau*-value towards the timing in there one only needs to observe one-dimensionally how the (alleged) line segments relate to each other. And so one doesn't have to exactly observe what letter trajectory *shape* is involved. That is a far more complex task. So conform Lee you could suppose that for the construction of the *tau*-value one only needs to observe how the gap between the letter and the slit approaches zero.

3. The motoric movement (MM) of the Motoric Movement Action *letter posting* – The secondary focus

The motoric movement (MM) in the Motoric Movement Action *letter posting* is very simple. If, like aforementioned, one divides the letter posting into three parts then it concerns a simple walking action,

[283] I often wondered why that should be necessary in a simple task like letter posting. Couldn't you skip the creation of a perceptual image of a latent action trajectory in there? Well that is hard to answer because our body just creates such an image in every Motoric Movement Action.

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a simple arm action and a simple throwing action. Because it is so simple I will not appoint it any further in this section. In this section I want to explain how the secondary focus is involved and appoint its connection with the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) which is of importance in the functional *tau*-coupling within the complete Motoric Movement Action.

In general the secondary focus in every Motoric Movement Action must be pointed at the biomechanical main action within the motoric movement (MM) towards the transition point in the direction of the action trajectory shape. This is formulated like this because in very complex movements, like a tennis service or a long distance golf swing, one is not able to avoid paying attention to aspects of the motoric movement (MM). In simple actions like letter posting that is not necessary. We don't have to pay any attention to a specific posting technique. However the rest of the general description concerning the secondary focus will stay. Within letter posting we always focus on the transition point, so not out of a not relevant technique, towards the letter trajectory. The transition point is the point where the movement action (MA) and the motoric movement (MM) come together. Or to put it in other words it is the point where they *transition* which the transition point literally indicates.
In letter posting these two transition in the point *between* the outside parts of the fingertips which touch the letter and the outside parts of the letter that are touched by these fingertips. So although the transition point is situated extremely close to the letter, which forms the essence within the movement action (MA), it doesn't have any overlap with the letter. They belong to two irreconcilable worlds. The letter is part of a line segment shape, outside the body, between a random starting point and the slit of a mailbox within the movement action (MA). This line segment shape can only be executed by the motoric movement (MM) which is only able to create movement trajectories, within the body, *until* (!) that transition point and not beyond that transition point. So even if the technique within the motoric movement (MM) is very simple, the secondary focus will always be pointed at, intentional or not intentional, movements within the body towards the transition point directed to the action trajectory shape. While at the same time the primary focus must be pointed at the completing of the action trajectory shape within the movement action (MA) outside of the body.

We are able to fully perceive all movement trajectories, also the movement trajectories within the aforementioned complex techniques like the service in tennis or the golf swing, within the motoric movement (MM) in a proprioceptive way[284]. However the explanatory model notices a few different phenomena within the proprioceptive perception. I will appoint those phenomena now.

Without direct vision we are able to clap behind our backs and to scratch an itching occiput and in pitch black darkness we are able to open a front door lock and in the same way we would be able to post a letter without any vision. Although alternative strategies exist the last two actions will then mainly be executed by bringing the non-key/letter hand to the lock/slit[285]. When two of our own body

[284] When we clap behind our back, without any vision, we construct two latent, *precise global*, action trajectory shapes within the movement action (MA) out of the two palms of our hands which have an intersection point at around the middle of our back. When we execute one clap we construct a perceptual image of the gap between the palms of our hands and we know exactly (from precise global to more and more precise) when the *tau*-value of that gap approaches zero. The transition point in this Motoric Movement Action is situated between (!) the outside of the palms of the hands that will produce the clap and the end of the relevant muscles within the body that manipulate the outside of the palms of the hands. Our clapping technique is so simple that we are able to execute this action by putting the primary focus on the leading gap within the movement action (MA) and by just putting the secondary focus, from the inside of the body, towards the transition point in the direction of the action trajectory shape. If we perceive that the leading gap of the action trajectory shape within the movement action (MA) approaches zero then we even are able to command the motoric movement (MM) in such a way that it can add a crescendo to the clap. We are able to perform this by proprioceptively accelerating the transition point within the motoric movement (MM) in the last phase of the action trajectory shape.
[285] Within the use of an ignition switch within a strange car you prefer to create an action trajectory shape with actual vision most of the time. In your own car you are so accustomed with the desired action trajectory out of your fixed seat position that you won't need any vision anymore. Still you will regularly experience proprioceptively that the tip of the ignition key is not situated at the exact right spot. However on the basis of this wrong *proprioceptive* touching (trial and error) you soon create the right action trajectory shape.

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parts[286] are involved, so when we are able to feel where they both are situated, we are able to construct a perceptual, *precise global*, image of a latent action trajectory shape solely on the basis of proprioceptive perception[287]. However this proprioceptive perception solely belongs to the movement action (MA) and has nothing to do with the proprioceptive perception within the motoric movement (MM) which I will address in a moment. This proprioceptive perception is solely occupied with perceiving the action trajectory shape and within there is perfectly capable of constructing a *tau*-value within the movement action ($tau^{G}{}_{MA}$) and to perceive the closing of the gap. So when for example a nightly mosquito picks a landing spot on our head we are capable of even creating an acceleration phase first and later a deceleration phase within the action trajectory shape from the palm of our hand to the head of the mosquito. This takes care of the fact that we will be able to close the relevant gap quickly but that we don't have to hit through our head but only *just until the outside* (!) of our head. This can only be done with the help of a strict and perfect *tau*-coupling in which the *tau*-value of the movement action ($tau^{G}{}_{MA}$) must be aligned precisely with the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$). And so it can happen that within letter posting in pitch black darkness we are simultaneously occupied with two different kinds of proprioceptive perception within the action trajectory shape and in the motoric movement (MM) which will be discussed later on.
However like aforementioned the proprioceptive perception within the movement action (MA) has nothing to do with the proprioceptive perception within the motoric movement (MM). In which of course we have to remark that the proprioceptive perception within the movement action (MA) could never be noticed because no one ever acknowledged the action trajectory shape within the explanatory model.
Current scientific research only links the proprioceptive perception to the motoric movement (MM) and has divided it in two groups. The proprioceptive perception in relationship to *movement* and the proprioceptive perception in relationship to *limb position*[288]. Although this scientific research *again* clearly tends towards the explanatory model it *again* is not capable of definitively explaining the found phenomena without a strict framework of that explanatory model.

"While we have learned a lot in recent years about the peripheral signals responsible for the senses of limb position and movement, the picture continues to evolve. We are beginning to recognize that the source of the signals can change, depending on the task undertaken. Yet we still know relatively little about the central processing of the incoming information. How do we derive the metrics of body parts, for example, or process constantly changing spatial signals during ongoing body movements? This is an area where we should focus future research efforts."[289]

Besides the novelty of the explanation of the proprioceptive perception within the movement action (MA), the explanatory model of the Motoric Movement Action also takes the found phenomena within this part of science one final step further. The explanatory model differentiates when it comes down to the complexity of the Motoric Movement Action and tells exactly when, how and where a secondary focus is needed out of the perspective of the *limb position*. It also shows that, regardless of the complexity of the action, the secondary focus must always be pointed at the transition point out of the perspective of the motoric movement (MM) because that is the *very last point* (!) which we are able to

[286] Or when flexible (motoric) movement objects are involved.
[287] Visual handicapped persons who use a blind man's cane do exactly the same. Now the fingertips are extended within the tip of the cane because the cane is a flexible (motoric) movement object. A user of the cane will now be able to construct a latent action trajectory shape between the tip of the cane and the feet (the transition point is actually that part of the shoe that will touch the pavement) within the Motoric Movement Action *walking* based on proprioceptive perception. I intentionally mention this specific example because it also shows that we not only proprioceptively perceive the tip of the cane but that we also *feel* if *nothing* is blocking the *whole* action trajectory shape by swinging the whole arm and stick. That is namely also the implicit goal when we probe the door looking for the key hole with the non-key hand in pitch black darkness. Also then we are *proprioceptively* feeling what obstacles we have to avoid within the whole shape. But because most of the time nothing will hamper us in that task this part is never acknowledged.
[288] See for example: U. Proske & S. Gandevia; The proprioceptive senses: Their roles in signalling body shape, body position and movement, and muscle force (2012).
[289] See the previous footnote.

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manipulate directly within the motoric movement (MM) towards that action trajectory shape. With the transition point the explanatory model translates the signalled phenomenon of the proprioceptive perception in relationship to *movement*. Till now current scientific research only came to the conclusion that proprioceptive perception *somehow* (!) has a relationship with movement within a motoric action. The explanatory model shows exactly that this phenomenon is explicitly related to the transition point and that the proprioceptive perception in there is strictly related to the motoric movement (MM). But it also shows that the transition point is often situated very close to the, movement of the, (movement) action object that it is able to cause confusion. Only the places P of the letter will construct the action trajectory shape within the movement action (MA) and the transition point, *between* (!) the places of the letter that will be touched by the fingertips and the places of the fingertips that will touch the letter, within the motoric movement (MM) from inside the body will only be able to take care that this action trajectory shape will be executed.
So the explanatory model shows that within a simple *self-paced* Motoric Movement Action like letter posting we mainly need to be occupied with the perception of the action trajectory shape within the movement action (MA). Because we hold on to the letter most of the time we are able to let the motoric movement (MM) just follow the perceiving of that action trajectory shape within the primary focus. Due to this we only need to observe the transition point out of *a* motoric movement (MM) within the secondary focus within letter posting.

a. The *tau*-value within the motoric movement ($tau^{G}{}_{MM}$)

Now within *self-paced* Motoric Movement Actions like letter posting the next phenomenon occurs. The action trajectory and the according *tau*-value of the movement action ($tau^{G}{}_{MA}$) is created by all consecutive places P of the letter. It is very important to stress in here that the movement action (MA) is only concerned with the letter and so only the letter shapes the action trajectory and determines the *tau*-value. Or in other words it has nothing to do with the transition point. Conversely the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) is created by all consecutive places P' of the transition point within the secondary focus[290]. Because we continuously hold the letter these points, P and P', will maintain to be close to each other[291] although in essence they fulfil two completely different goals. So they relate to different gaps but their *tau*-values can be observed as one because they fill in the relevant line segments in almost the exact same way. Or within other words the perception of the gap of the movement action (MA) automatically provides information about the gap of the motoric movement (MM). So in these kinds of Motoric Movement Actions one is able to say that there is an equalization of gaps. This implies that you are able to pause the action trajectory at any moment when you for example need to sneeze. The pausing of the gap of the action trajectory will automatically pause the gap within the motoric movement (MM). If you resume the movement action (MA) then the observing of the gap within the motoric movement (MM) will also be resumed simultaneously and will continue with the movement of the letter till the leading *tau*-value ($tau^{G}{}_{MA}$) will approach zero. Although in common language one doesn't call this timing you are able to see that self-paced actions are timed as well. In future topics I will refer to this phenomenon as *self-paced* timing. If the visual perception processes observe that the *tau*-value of the movement action ($tau^{G}{}_{MA}$) approaches zero then the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$) is guided in such a way that it also approaches zero.

4. The complete Motoric Movement Action *letter posting*

[290] In for example the Motoric Movement Action *catching*, appendix B, this transition point trajectory is a really different line shape than the action trajectory.
[291] So for all clarity our primary focus during letter posting is only observing the movement of the letter. That includes the *tau*-value of the letter trajectory. At the same moment our secondary focus is observing the transition point where we hold the letter. As aforementioned we do that out of a certain technique but that doesn't need special attention. But it does need attention though. So during posting you visually observe all points P of the letter towards the slit of the mailbox and at the same time you proprioceptively observe all points P' of the transition point out of the movements within your body.

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The description of the two only organs of the Motoric Movement Action can leave the suggestion that they are linear or otherwise separated processes. That is a misconception. Both organs are part of one undivided complex system. The explanatory model explains the Motoric Movement Action as a complex system. The description of the motoric movement (MM) and the movement action (MA) only concerns the explanation of the two complex subsystems. During the execution of a Motoric Movement Action they need to be executed simultaneously. The explanatory model explains which perception processes in both parts are needed and out of which perspective they need to be perceived. The explanatory model is connecting the processing processes of the perception to the movement action (MA) and proprioceptive perception to the motoric movement (MM) but it doesn't exclude that some perception processes show overlaps. So in letter posting the primary focus must be pointed at the letter trajectory shape and at the same time the secondary focus must be pointed at the biomechanical main action towards the transition point of that action trajectory.

a. The *tau*-coupling within the complete Motoric Movement Action *letter posting*

Both foci arise out of the obligatory simultaneous cooperation of bottom-up and top-down perception processes. That insight definitely ends the perception-action dichotomy within scientific debates. One can only get convinced of the *tau*-values within the movement action ($tau^{G}{}_{MA}$) and the motoric movement ($tau^{G}{}_{MM}$) if one will understand the exact origin. You are only able to depict a gap when you try to visualize a perceptual image of a latent line segment shape as sound as possible and take away the manifest part of the actual positions of the (movement) action object or the transition point within that perceptual image. The gaps follow each other as aforementioned. The leading gap is always created by the movement action ($tau^{G}{}_{MA}$). It is leading because the letter is the (movement) action object and forms the essence of the action which we are not able to influence. The *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) will have to follow because it executes the movement action (MA) and because we conversely are able to influence it in a proprioceptive way. The *tau*-coupling occurs during the whole action within the letter posting and also shows that and how both processes must be executed simultaneously.
However as aforementioned the timing is not really relevant in the first two phases of the Motoric Movement Action *letter posting* because we hold the letter constantly. In the final phase of the letter posting when the letter is actually inserted into the slit of the mailbox the *tau*-coupling becomes more significant. Even this tiny throw needs a *tau*-coupling[292]. Although a very small distance A-B is involved a small energy transfer is needed and therefore a small initial phase needs to take place. The *tau*-value of the movement action ($tau^{G}{}_{MA}$) is now determined by how the letter fills the small line segment A-B of that initial phase. The *tau*-value of the transition point towards that action trajectory within the motoric movement ($tau^{G}{}_{MM}$) will have to follow this leading gap and will have to provide the message to the motoric movement (MM) to completely release the letter from all the fingertips once the letter approaches B. So with other words if we perceive that the *tau*-value of the movement action ($tau^{G}{}_{MA\ A\text{-}B}$) approaches zero then the *tau*-value of the motoric movement ($tau^{G}{}_{MM\ A\text{-}B}$) also has to approach zero and gives the order to take all fingers of the letter at the exact same moment at all transition points.
In that way the *tau*-coupling can be brought back to the primary and secondary focus. The primary focus in a throwing task must be pointed at the initial phase of the action trajectory shape and especially at the previous determined end point of that initial phase. The secondary focus in a throwing task must be pointed at the transition point towards the action trajectory shape out of the perspective of the throwing technique belonging to the motoric movement (MM).

5. The letter posting task and the patient D.F.

[292] The essence of a throwing task is that the (movement) action object (the letter) must pertinently be held over a certain (very tiny) line segment A-B in which the initial phase of the object trajectory will be shaped. That initial phase is essential for the near future shape of the action trajectory and for the transfer of energy. When the action object approaches B the body parts which hold the object must receive the message to release from the object at the exact same time.

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The explanatory model of the Motoric Movement Action provides insight in all processes at the functional level and because of this we are able to arrange all Motoric Movement Actions concerning their complexity. The explanatory model also shows in there that we often use one standard procedure to execute an action but that we are able to complete tasks in various other ways[293]. This latter insight also provides a link to the aforementioned fact that we are able to implement abstract cognitive knowledge about all kinds of action trajectory shapes in a maximal creative way.
So I always wonder how I would execute a Motoric Movement Action in pitch black darkness and split that question in two parts concerning a *known* and an *unknown* environment.

If we are going to post a letter in pitch black darkness in a *normal* way then you probably will raise your not-letter hand to the slit of the mailbox first to create a perceptual image of a latent action trajectory. So now we don't perceive this visually but we visualize a latent action trajectory out of non-visual perception[294]. If the direction of the slit, for example in a scientific setting, could be varied then we perceive the specific direction of the slit in the exact same way with the not-letter hand and we accordingly adjust the letter position in our letter hand.
However if you were only allowed to use the letter hand you also will be able to successfully execute this task. So now you are not able to execute this task *as normal as* you are used to execute it but you are going to execute it within the abstract possibilities which remain within the task. Now with the letter hand you are going to probe the surroundings with the only goal to just find the slit. This execution is also based on the fact that we cognitively know that in a letter posting task the letter only needs to cross empty space, *nothing*/*the void*, first just in order to get close(-r) to the slit[295]. We cognitively know that we don't need to achieve anything more in this phase of the execution of this task. Once you found the slit with the letter hand, as aforementioned out of proprioceptive perception, you then start to compare the letter direction in your hand with the direction of the slit of the mailbox because cognitive knowledge instructs you that a letter will not enter a slit transversely. Then you try to align the two directions with the help of trial and error. You repeatedly will take the letter a little distance from the slit and place it back in a slightly altered way. The proprioceptive feedback which you will receive from this process will finally lead to successful alignment of both directions.

Now we come to the patient D.F.[296]. Out of the aforementioned the explanatory model of the Motoric Movement Action is able to formulate a clear explanation to the question why the patient D.F. is able to execute a posting task, in normal day light, successfully although she doesn't own a properly functioning ventral stream anymore. The patient D.F. is for example not able to cognitively tell in which direction the slit of the mailbox is shaped in any phase of the task. The aforementioned explanation in pitch black darkness tells exactly why this ventral stream is not essential at all and that we are able to execute tasks in different ways. D.F. is just able to bring the letter closer to the slit out of the aforementioned abstract idea that a letter first needs to come closer to a slit. Or maybe out of an even more abstract idea that the gap between two items just needs to be closed first for most of its part. Then like in pitch black darkness she could use the trial and error method but even that is not necessary in here. Because once she will see both items, the letter and the slit, within one visual image she will be able to

[293] The explanatory model clearly shows in there that if visual perception is involved that it belongs to the movement action (MA). But visual perception is not necessary for a Motoric Movement Action as long as a perceptual image of a latent action trajectory shape is created. Conversely the proprioceptive perception is always involved in the motoric movement (MM).
[294] In a scientific setting the area between the letter and the slit will not be occupied. Just like what you will experience during your daily posting tasks. But however the space between the letter and the slit is empty one of the main goals of the perception processes is to determine one free action trajectory shape through the *nothing*. Only *nothing* will guarantee a successful action trajectory shape *between* the animal and the environment. .
[295] At a micro level the first task is just to bridge the space in an environment. The explanatory model, conform Gibson, defines the animal-environment relationship crucial and states that the relationship is shaped by the space between the animal and the environment. But because this space is invisible we were not able to see that it is an existing entity.
[296] https://en.wikipedia.org/wiki/Patient_DF; http://psychsciencenotes.blogspot.nl/2012/04/patient-df-uses-haptics-not-intact.html.

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just align the two without ever having to cognitively appoint any shape or any direction. And so the the patient D.F. will be able to successfully execute this task as well as many grasping tasks with this *comparing*-method. In the Motoric Movement Action *grabbing/taking/touching* this method is even considered to be the main strategy within healthy people as well.

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Appendix D – The Motoric Movement Action *grabbing/taking/touching*

The simple complex task of grabbing/taking an apple out of the fruit basket

"The moment we are going to grab an apple we focus on one, precise global, line segment shape, a marble run through the void, from the fingertips to the apple. We perceive this very specific line shape between the fingers and the apple preferably with direct vision. At that same moment (!) we also focus on the motoric movements, within the body, which are necessary for the execution of that grabbing. We perceive these movements in a proprioceptive way. So when we are grabbing an apple we visually focus on the outside of the fingertips which will form, or are part of, a connection[297] with the outside of the apple and simultaneously we proprioceptively focus on the motoric movements on the inside of the body towards the outside of the fingertips that will touch the apple."

With the completion of the explanatory model of the Motoric Movement Action all complex perception processes in all actions can be explained at the functional level. As an illustration I will briefly appoint the processes in grabbing an apple to clarify what exactly happens but also why current science wasn't able to come to that level yet. In retrospect it will appear that just too much complex variables were involved.
Right after we formulated an egocentric will to grab an apple we create an action trajectory out of the movement action (MA). The action trajectory encompasses a perceptual, *precise global*, image

[297] The explanatory model shows many overlaps with *The Affordances Theory* of J.J. Gibson. They both claim that the moment a basket full of red apples is placed before you in a completely white room latent action trajectories arise between your hands and all grabbable apples. They arise, *they are afforded*, the moment the basket is placed there and so they have nothing to do with a possible formulation of an egocentric will. The movement action (MA) solely describes that part of the Motoric Movement Action that is concerned about the animal-environment relationship.

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of a latent line shape. Within grabbing with the hand this action trajectory is shaped out of the perspective of these fingertips surfaces (the transition point) that will touch the apple and this line segment shape is situated on the outside of the body between the hand and the apple. In essence this line is going to fulfil our egocentric formulated will but we are not capable to directly (!) control this line with body movements. That is why we primarily need to pay attention to this line shape and monitor it with direct vision. However if we want the relevant hand surfaces to approach the apple then we will have to move them with a motoric movement (MM), on the inside of our body, which conversely we do control. So we are able to establish in here that the egocentric formulated will is executed by the movement action (MA). The motoric movement (MM) is only executing the movement action (MA) and therefore it definitely needs attention but this attention must be pointed at the transition point towards the action trajectory.
This is a description of a complex task. If the action trajectory progresses and the transition point approaches the apple then the attention within the motoric movement (MM) will simultaneously shift with the place of the transition point. However if you will be able to recognize this you will see that it is a *simple* complex task.

Before I will appoint this action I first will have to emphasize explicitly that the Motoric Movement Action *grabbing/grasping/taking* scientifically really doesn't exist. According to the explanatory model this Motoric Movement Action technically contains two autonomous actions within a binding linked script. The first Motoric Movement Action *touching* always precedes the second Motoric Movement Action *pressing/throwing*[298]. The crucial observation in there in short concerns the fact that if one is actually going to execute (!) the first part of the script one doesn't need to be occupied at all with the completing part of the script during the actual movement action[299] (MA) within the touching. In that first part of the script then one solely needs to be occupied to actually bridge the *nothing* between the fingertips and the object and not with the object itself[300]. So this autonomous Motoric Movement Action which only covers the touching owns its own autonomous *tau*-coupling and this has no overlap whatsoever with the *tau*-coupling within the adjacent Motoric Movement Action *pressing/throwing*. When one experiences the first haptic sensation of any outer part of for example an espresso cup with the fingertips then the first part of the script and the coinciding *tau*-coupling ends immediately[301].
The *whole* (!) espresso cup has only been a part of the first part of the script within the tactical movement action[302] and that is the phase right *before* (!) the actual movement action. It is very obvious that within this tactical movement action the whole espresso cup shape has been *tactically* assessed based on a huge general cognitive basis and that results finally in the choice for one specific action trajectory

[298] Like one is also able to experience the pressing of a piano key as a throwing action, in the same way one can experience the motionless holding of an object as a pressing/throwing action of all relevant fingertips. The difference with the piano key however is the fact that within the motionless holding the end resultant of all vectors must be maintained at zero.
[299] The actual movement action just starts a brief moment after the tactical movement action came up with a final choice for one, *precise global*, action trajectory shape.
[300] That is to say that one doesn't need to be occupied with the object as a part of the next phase in an obligatory way but that one is free to be occupied with it at a voluntary basis.
[301] In here I will not extensively assess the second part of this script. In short the actual motoric movement (MM) of the *throwing/pressing/grabbing* technique of this script just starts in there. The motoric movement (MM) and the corresponding *tau*-coupling within the sole touching only has a relationship with how movement trajectories within the body move the fingertips over the action trajectory shape towards an espresso cup and has no relationship whatsoever with the upcoming *throwing/pressing/grabbing* technique. Because that technique will be part of another autonomous Motoric Movement Action with its own *tau*-coupling. You can clearly witness this in for example playing the piano in which the touching and pressing are must also be combined in a forcing linked script but must be observed as two autonomous Motoric Movement Actions. The pressing of a piano key has its own *tau*-coupling.
[302] So except from this part the properties of the cup are not a subject of this part of the script at all. The action in here, conform Gibson, must be observed *out of the perspective of the body*, the animal, towards the environment.

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shape with which we think we are able to actually grab the cup in a successful way[303]. That action trajectory shape will definitely consist how and where the fingertips will, *later* (!), have to touch the outside of the cup in order to be able to create a counter-pressure. So during this tactical movement action a *precise global* perceptual latent image is created of an action trajectory shape to which the hand aperture or even more correct *the width/aperture of the fingertips* will need to comply to[304].

However the next part is hard to explain. It has to do with the fact that out of this phase of the script most contaminated data arise within current scientific research and that again has to do with the fact that the explanatory model is still unknown. I will try to explain it. Because there is a binding linked script involved I don't need to be occupied *at all* (!) with the upcoming *pressing*-process during the actual execution of the *touching*-process but that doesn't mean that test subjects will refrain from doing so. You find a clear example within the Motoric Movement Action *letter posting*. Even *before* (!) the action trajectory shape is executed within the actual movement action one is able to adapt the shape of the letter to the shape of the slit of the mailbox[305] but the action doesn't demand this in this phase. You are perfectly capable of fulfilling this task if you wait for the letter to arrive close to the slit and just then start adjusting the directions. When I speak out of my own experience I think that most people will adjust the position of the letter gradually along the action trajectory shape within a letter posting task but within science this subjective choice must be acknowledged.
In that way it is also clarified why the patient D.F.[306] is also capable of fulfilling a letter posting task because she just fulfils the minimal requirements[307] which this task demands. First she *only* (!) brings the letter, in whatever position, closer to the slit and when she is able to observe both the letter and the slit in one direct visual image she just aligns the shapes of both objects. She executes this task successfully without ever having to form a precise cognitive image of the shape of the slit. And that in fact will likely also be the most used strategy within test subjects while grasping objects. If test subjects are capable to accompany an action with direct vision then most of them will wait until the grasping areas of the hand aperture will show up in one direct visual image together with the grasping areas of the espresso cup. So although healthy people[308] beforehand created a tactical *precise global* image of what to expect technically *later on* (!) one will very likely prefer to just *compare* images at the end of an action and to align them out of parsimonious deliberations. But nothing can be said with certainty about these strategies and so within scientific research one needs to exclude these *personal preferences*.

I will appoint this into more detail in the near future when I am going to review current scientific research. The essence of the original flaw within that research is probably coming forward out of our daily language. In colloquial language we emphasize that our egocentric formulated will is especially aimed at getting that particular object. "I want to grasp *that* espresso cup!". In that way the perspective is centred at the *cup*[309] but that cup is not part of this action. As aforementioned the object does absolutely nothing and needs to be positioned much more at the background and the egocentric will must

[303] So the tactical movement action within the Motoric Movement Action *touching* in there definitely has to assess the second part of the script but once the Motoric Movement Action *touching* will be executed one is only occupied with the *touching*.
[304] So a definite property of this action trajectory shape within the first part of the script must contain the fact that at the end of the action trajectory the fingertips first need to be opened a little wider than the actual object to open up the possibility to execute a later *encapsulating* (!) movement.
[305] In which you actually execute a motoric movement (MM) which is only demanded within the next script phase. In that way data will be contaminated because some people chose to prepare some motoric movements (MM) in advance.
[306] The patient D.F. is even known within the Wikipedia due to her flawed functioning of the ventral stream.
[307] Within the Motoric Movement Action *touching* the main and in fact the only task is just to bridge the *nothing* and bring the (movement) action object (the fingertips) closer to the object.
[308] The patient D.F. will also be able to grasp an espresso cup successfully but in that task she will also have to rely on the same *last-minute comparing*-strategy. Also in this task she will not be able to construct any thoughts within the tactical movement action as we are able to do because also in this case she is not capable to visually process the end shape beforehand towards the ventral stream.
[309] And that is also due to the fact that the object which we want to grab is often perceived with direct vision and that it looks like we are focussing on that object. But that is not what we are doing. The object as the ending

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be formulated in such a way that we want to get something into our *hands* (!). In which we actually express that we want to move our hand(s) towards that something. "I want to move my hand towards that espresso cup! And then I want my hand to hold it.".

However in here I will review the Motoric Movement Action *grabbing/grasping/touching etc*. in the way we regard it as in our daily language as well in current scientific research. You can say that in here the ordinary, *the functional*, meaning of grabbing/taking is involved.

1. Introduction

The Motoric Movement Action *grabbing/taking/touching* is a kind of general action which we daily execute many times in a script and is often combined with the Motoric Movement Action *letting go/putting down/throwing etc.*. In the script concerning a letter posting[310] task the letter first needs to be grabbed from the writing desk. Also in the script concerning the Motoric Movement Action *writing*[311] the pen first needs to be grabbed from the table and then the tip of the pen must be connected to the surface of the paper with the Motoric Movement Action *touching*. Only after these two actions are completed the actual Motoric Movement Action *writing* is able to begin. When the writing is done the pen will be *put down* again.
They are all different Motoric Movement Actions because the perspectives within the action trajectories of all those actions are essentially different. When we first want to grab the pen within the writing script the latent perceptual image of an action trajectory is shaped out of the perspective of the actual outside surfaces of the hand which will touch the specific outside of the pen. The moment the pen is held into the hand the perspective of the action trajectory changes at once. The latent perceptual image of an action trajectory is then shaped out of the perspective of the tip of the pen between the tip and the place on the paper from where the beginning of the first letter will start. As soon as the tip touches the paper that Motoric Movement Action is finished as well and then the action trajectory is shaped by the first letter that will appear on the paper. This last Motoric Movement Action is unique because of the fact that the action trajectory actually becomes visible[312]. When the writing is done and we want to get rid of the pen the latent perceptual image of an action trajectory is shaped between the outside of the pen that will touch the table and the spot of the table that will touch the pen.
If you would study this script then you are able to see essential differences within the (movement) action object. The action object can be divided into three groups. It can be 1. a not-bodily object (letter, ink/pen, ball etc.), 2. a body part or 3. the whole body. The whole body is not mentioned in any of the aforementioned script examples.

Although we primarily think of *grabbing/taking/touching* something with the hand in the basal description of this Motoric Movement Action, *grabbing/taking/touching* with the mouth/feet etc. also happens on a regular basis[313]. And besides that we grab a lot with the help of (motoric) movement objects. In the following explanation I will however stick to the basal grab action with the hand.

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point will have its definite influence on the action trajectory shape but within that part of the script we mainly look at the whole shape *between* (!) the fingertips and the object out of the perspective of the fingertips and we observe the object as only the last point P of which all other places P(x) are of equal importance through the *nothing*. Although we assess the *whole* object as a part of a *whole* script tactically within the tactical movement action, during the actual *touch* action we are only assessing the situation until just the very outside of the object. Because the touching-script will stop at the moment the haptic perception experiences the first touching sensation.

[310] Addendum 2; Appendix C.

[311] See addendum 1.4; Appendix A.

[312] There are not a lot of these kinds of Motoric Movement Actions with visible action trajectories. In addendum 1.4 the Motoric Movement Action *pouring* and the Motoric Movement Action *nerve spiral* are appointed as well.

[313] At a micro level the Motoric Movement Action *walking/running* for example consists of linked Motoric Movement Actions touching (with the foot).

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The task within the Motoric Movement Action *grabbing/taking/touching* with the hand is to put the outside of the hand against another body part or object[314]. The explanation of a Motoric Movement Action with a body part is much harder to imagine than an explanation of a Motoric Movement Action with an external object. So it is recommended that you first study the Motoric Movement Action *letter posting* thoroughly before you will study this description. You will first need to gain insight that for example the letter with all its places P shapes one *letter* trajectory, outside the body, during the execution out of the perspective of the letter and that completely different (motoric) movement trajectories, within the body, execute that *letter* trajectory. In terms of lines/trajectories they don't have any relationship.

Image: The Motoric Movement Action *grabbing/taking/touching* is regularly executed with a (motoric) movement object. Especially when it concerns very hot (frying pan) or very small objects (splinters). But also food nowadays is mainly grabbed with a flexible (motoric) movement object out of ethical and hygienic considerations. They are all examples of objects which we are able to maneuver freely and which will expand the motoric movement (MM) with one extra movement trajectory. That is why the complexity of these actions is raised with a factor. However we need to remark in here that in a script all those objects need to be picked up first with the basal grab action with the hand.

The grabbing of an object with the hand however mainly follows the letter posting task. The only difference now is that there is no solid object fulfilling the egocentric formulated will but that a certain part of the outside of the hand is involved. The only thing that will fulfil the essence of the task is the specific outside of the hand that will touch the outside of another body part or object. It is crucial that you are going to understand that just like the letter we are able to move the outside of the hand over a line shape but that we don't move it on the outside of the hand. Just like the heart and the lungs, situated at another spot, actively cooperate in this process so the outside of the hand is moved elsewhere. If we simplistically represent grabbing actions by movement trajectories within the arm then you could say that mainly antagonistic muscle groups within the arm are responsible that finally muscles on the inside of the fingertips are activated. Although those muscles on the inside of the fingertips will be situated immensely close to the outside of the fingertip the one will never have something in common with the other. A movement trajectory always begins and ends within the body and the action trajectory shape is always situated outside of the body. They belong to two irreconcilable worlds.

The outside of the hand is not moved on the outside of the hand.

[314] Grabbing mainly consists of the Motoric Movement Action *touching*. The Motoric Movement Action *grabbing/taking* arises by creating a counter-pressure in the specific body surfaces that actually *touch* the object. I pick up a letter with three fingertips. The thumb on the one side and the index and middle finger on the other side create a counter-pressure. But the main part of this action consists of touching. The counter-pressure can only be created in the very last phase after the touching is being realized.

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Just like the ball, the ink or the letter the outside of the hand is a completely autonomous entity. It must be examined like the heart and the lungs. They are also autonomous organs which are for example essential for running but don't contribute to the actual locomotion of the legs. The outside of our body isn't capable to do anything on its own. We are able to obviously determine that with for example our (former) hairdo. Just like the heart and the lungs it will just come along because it is connected to an entity that is moved at a different location. It remains funny to say but the outside of our body is as lifeless and motionless as the letter in relationship to a Motoric Movement Action. Just like in all Motoric Movement Actions we will have to move the motionless outside of the hand with movement trajectories within the body which we do control. The Motoric Movement Action *grabbing/taking/touching* can only be executed if we simultaneously keep the primary focus on the essence of the task, the action trajectory out of the outside of the involved hand surfaces, and keep the secondary focus on those movement trajectories within our body that will execute the grabbing. You probably find that hard to imagine because we have automatized this action completely. Although it is a complex process you are able to execute it in complete *flow*. Within the grabbing/taking you have a multitude of latent action trajectory shapes at your disposal which you have practiced every day from even before the day you were born and besides that the movement trajectories are very simple. That is also due to the fact that, unlike catch and throw actions, we are able to adjust the action trajectory at any moment.

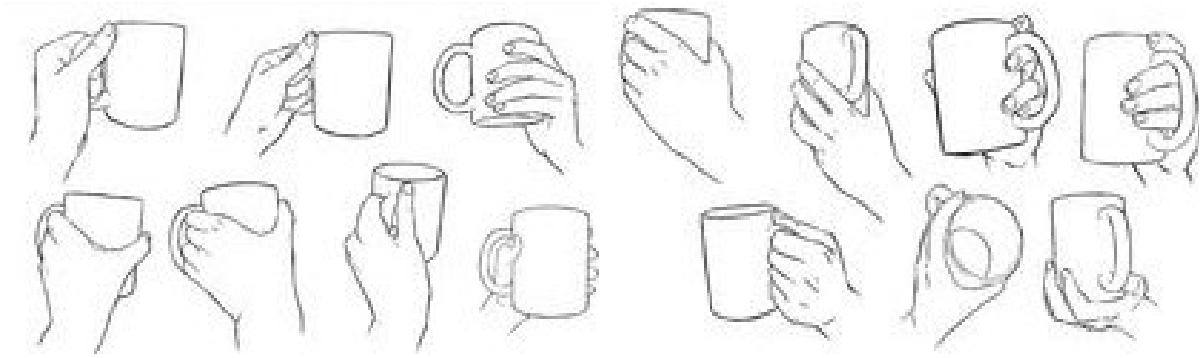

Image: Within picking up solid objects the hand accommodates a multitude of *grabbing* possibilities as you can see in picking up a mug. It is impossible to appoint all those possibilities with the outside of the hand in a general description. It is more important to appoint the fact that we cognitively know that the whole letter or mug will come along by holding just a part of it. That seems very logical but because of this it is never noticed[315]. Just like the *nothing* (the void) within an action trajectory is never noticed. This cognitive knowledge *automatically* leads to the tactical adaption that grabbing water is approached in a very different way just like we develop different tactics to grab a very flexible bread dough or Silly Putty. This cognitive basis/knowledge is therefore very important and will be further appointed within the tactical movement action.

It is impossible to appoint all grabbing/taking variations. In the next description the Motoric Movement Action *grabbing/taking/touching* of an espresso (coffee) cup is appointed. The grabbing of such a cup is possible by the counter-pressure of three fingertips of on the one side the thumb and the other side the index and middle finger *touching* the grip of the cup.

2. <u>The movement action (MA) of the Motoric Movement Action *grabbing/taking/touching* – The primary focus</u>

[315] It is one of the many essential abstractions our cognitive basis possesses.

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The explanatory model of the Motoric Movement Action appoints three parts within the movement action (MA). The cognitive basis, the tactical movement action and the actual movement action[316]. Within grabbing/taking we possess an incredible basis with general knowledge about the action trajectories. The limited assignments within addendum two[317] already show a wide range of possible action trajectory shapes. And that only concerns the grabbing of a coffee mug/tea glass with one hand grip to the right side, at one set distance and at one set height. Maybe we possess even more action trajectory shapes within the Motoric Movement Action *grabbing/taking/touching* than we possess in the Motoric Movement Action *writing*. Of course each action trajectory looks a lot like all the other action trajectories but they are actually unique lines with unique inflexion points, lengths etc.. The cognitive basis even possesses all the action trajectories of all taking/grabbing actions and all other Motoric Movement Actions. Normally you will easily take possession of the espresso cup but in the rare case that this isn't possible this huge cognitive basis will allow you to improvise maximally[318].

Image: In the description of the Motoric Movement Action *grabbing/taking/touching* the grabbing of a little espresso cup is the main goal. The grabbing is possible and appointed out of the perspective of the fingertips of the thumb on the one hand and the index and middle finger on the other hand. They will *touch* the handle of the cup first and then will be able to *grab* the cup by creating a counter-pressure in those fingertips.

During the tactical movement action this general knowledge is translated to the actual grab/take/touch situation of that moment. What needs to be grabbed? At what distance does it have to be grabbed? Etc. etc.. Finally the cognitive basis and the tactical movement action, *the tactical department*, will have to come forward with the choice of one action trajectory shape because in one Motoric Movement Action only one action trajectory can be executed[319].
So the general cognitive image is transformed to a more specific action trajectory shape at the actual *grab* location due to the tactical movement action. This, *precise global*, shape then serves as the basis for the actual movement action and consists of a perceptual image of a latent action trajectory. So

[316] If one will acknowledge that we execute every Motoric Movement Action with action trajectory shapes from day one in life and that within there an obligatory cooperation is demanded between perceptual images and actual online perception processes then one will also acknowledge that there must be a basis with many recorded images of action trajectory shapes. This general tactical base will then be placed over the specific situation during the tactical movement action. Just before the actual movement action will execute what has been decided in the tactical department. So this threefold division is not a part of any theory but just the logical consequence of the acceptation of the explanatory model.
[317] See: addendum 2-6; p.
[318] The cognitive basis not only encompasses a huge arsenal of action trajectory shapes but also a huge amount of abstractions concerning the action. See the conclusions about the assignments and the letter posting task and the patient D.F..
[319] If you feed a toddler it doesn't make any difference how many loopings the *food* plane executes. Within one bite of the Motoric Movement Action *eating* it will remain just one action trajectory.

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when a little espresso cup is involved we construct a perceptual image of a latent action trajectory shape out of the perspective of the fingertips that will touch the cup between those outside parts of the hand and the outside of the cup that will be touched. An action trajectory that can be compared with a marble run. The aforementioned advantage of this *open* and *flexible* marble run, as compared to a set classic marble run, is the fact that the fingertips are not bound to one fixed route but that they are able to adjust themselves to any (sudden) obstacle that could possibly hamper a successful grab action. However the aforementioned disadvantage of such a marble run is the fact that possible deviations must be monitored continuously. The explanatory model connects this monitoring to the processing processes of the perception, the dorsal stream and ventral stream. The ventral stream mainly observes the action trajectory but in relationship to the actual place of the hand. The dorsal stream is mainly occupied with the actual place of the hand but in a narrow relationship with the action trajectory shape. These processing processes of the perception will continuously need to audit each other in an ongoing mutual process during the actual movement action in which the actual place of the fingertips determines the actual action moments. If the hand slightly deviates from the assumed *action path* a new perceptual image is created immediately out of the manifest part of the action trajectory. Then again the hand will be obliged to follow this perceptual image and again will be monitored by the dorsal stream. This mutual process will continue until the fingertips will finally touch the cup.

a. <u>The *tau*-value of the movement action ($tau^{G}{}_{MA}$)</u>

Within the movement action (MA) one is foremost occupied with the creation of an action trajectory shape in which the emphasis must be put on the word *shape*[320]. The shape encompasses multiple dimensions with exact inflexion points, lengths etc.. The *tau*-value is only a limited and simple component of that shape. For the *tau*-value the emphasis in line shape must be put on the word *line*. To determine the *tau*-value one only needs to observe how the (movement) action object, i.c. the relevant fingertips, is actually filling in the perceptual visualized (action trajectory-) line. That is just a one-dimensional task which only has to observe with which speed, with which value, a latent line segment is closed. The *tau*-value of this movement action ($tau^{G}{}_{MA}$) is constructed by perceiving how the perceptual image of a latent action trajectory is filled with a manifest line created by the actual places P of the relevant fingertips. So when we reach for an espresso cup we just can observe the gap, *the void*, between the fingertips and the handgrip and see how that *line* segment becomes smaller and finally become zero.

The actual movement action shows in there a clear and necessary cooperation of cognitive-perceptual shaped images and bottom-up perception processes[321]. This definitely ends the perception-action dichotomy and tells us that they both are simultaneously needed and that they are always present during the actual movement action within every Motoric Movement Action. Only when one will understand that the grabbing of an espresso cup also requires both kinds of perception processes, only then one will be able to grasp how the *tau*-value of the movement action ($tau^{G}{}_{MA}$) can be determined.

3. <u>The motoric movement (MM) of the Motoric Movement Action *grabbing/taking/touching* – The secondary focus</u>

The motoric movement (MM) in this Motoric Movement Action is very simple. That is why we are able to execute it in full *flow*. The *grab/take* technique constitutes movements of the upper arm (abduction-adduction), the elbow (flexion-extension), the lower arm, the wrist etc.. This is a sparse description. If you want to be more thorough you should also appoint all motoric movements out of the

[320] Especially within complex sports like tennis, cricket, baseball etc. the shape of the incoming ball trajectory and outgoing ball trajectory is all that matters.
[321] I often wondered why this is necessary in simple tasks like for example letter posting. Will you not be able to execute the task without a perceptual image of a latent action trajectory shape? That question is hard to answer because we execute that part in such an implicit way.

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unity model[322]. So you should not only appoint the relevant fasic muscle groups but all muscle groups. However the only goal of this paragraph is that you start to see that we are only able to manipulate the outside of our fingertips, the (movement) action object, with these completely different movements. We are not able to move the outside of our fingertips in a direct way. They are not capable of doing anything by themselves and they never will. It is very odd to say but concerning the Motoric Movement Action the outside of our body is a motionless entity. In spite of the fact that they are constructed out of living cells. These living cells do make movements within their autonomous life cycles but mere mortals are not able to control these in a direct way and directly execute Motoric Movement Actions with them.
The movement trajectories are related to the motoric movement (MM) and the action trajectory shape is related to the lifeless (movement) action object within the movement action (MA). These line segments have nothing in common and will never share anything in one Motoric Movement Action. Because of their difference in perspective they belong to two irreconcilable worlds.

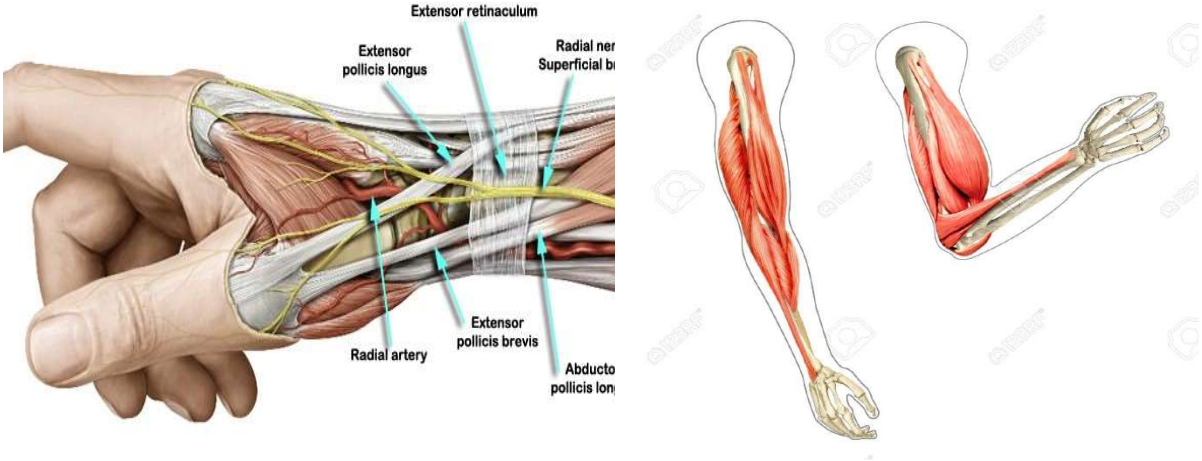

Image: Movement trajectories within the Motoric Movement Action *grabbing/taking etc.* are constructed within the body. With the motoric movement (MM) as well as the movement action (MA) the body has chosen for a generic system to execute all possible action trajectory shapes with a universal set of movements. The movements within grabbing/taking/touching etc. mainly sprout from antagonistic collaborations of muscle groups within the hand/wrist/lower arm/elbow/upper arm. So movement trajectories we are able to observe on the outside of the body are a translation of the original movements. The origin of movement lies within the body and is not visible on the outside.

Because the motoric *grab/take*-movement is very simple I will not further appoint the grabbing technique. In this paragraph I want to show how the secondary focus is involved and within there make the connection with the *tau*-value within the motoric movement ($tau^{G}{}_{MM}$) because it is essential in understanding the functional *tau*-coupling during the execution of the whole Motoric Movement Action *grabbing/taking/touching etc.*.

a. The *tau*-value of the motoric movement ($tau^{G}{}_{MM}$)

[322] The unity model is the biomechanical model that belongs to the explanation of the motoric movement (MM) within the Motoric Movement Action. The unity model got this name because the whole body must become one unit during each separate Motoric Movement Action and due to the fact that the motoric movement (MM) serves the movement action (MA) which has the goal to create just one action trajectory. It then doesn't matter how many movement trajectories are needed within the motoric movement (MM) and which time scale is involved. It is all part of *one* complex subsystem. For more see; *Caught In A Line*; p. 104.

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In general the secondary focus in every Motoric Movement Action must be pointed at the biomechanical main action within the motoric movement (MM) towards the transition point in the direction of the action trajectory. This is formulated like this because in very complex movements, like a tennis service or a long distance golf swing, one is not able to avoid paying attention to aspects of the motoric movement (MM). In simple actions like letter posting that is not necessary. We don't have to pay any attention to a specific posting technique. However the rest of the general description concerning the secondary focus will stay. So when we reach for an espresso cup we always will focus on the transition point towards the action trajectory. The transition point is the point where the movement action (MA) and the motoric movement (MM) come together or more exactly where they *transition*.
Within grabbing an espresso cup they transition in the point *between* (!) 1. the end of the muscles within the fingers which allow the relevant fingertips to move and 2. the outside of the fingertips that will touch the cup. So the transition point is situated immensely close to the outside of the relevant fingertips but will always remain within the body within this Motoric Movement Action. Conversely the action trajectory shape is situated on the outside of those fingertips and is created out of the perspective of those fingertips. So the transition point and the outside of the fingertips are only a few millimeters away from each other but the one is based on the inside and the other one is based on the outside of the body. As aforementioned they belong to two irreconcilable worlds.

So in this Motoric Movement Action the similar situation occurs as in the Motoric Movement Action *letter posting*. All places P of the letter will create the action trajectory shape. The transition point (P^T) in here which is controlled by the motoric movement (MM) on the inside of the body is situated *between* 1. the outside of the letter that is touched and 2. the outside of the fingertips that touch the letter. So all the places P and P^T will remain very close together until the letter is finally thrown into the mailbox. So like all places P of the letter form a line segment all the places P^T also form a line segment and describe almost the same trajectory. This has the *automatic* consequence that if the *tau*-value of one line segment changes the other *tau*-value changes in the exact same way. In daily life we don't appoint this as timing. But also in this Motoric Movement Action there is a *tau*-coupling[323] because our primary focus is aimed at the action trajectory shape and the secondary focus is aimed at the transition point. The explanatory model calls this *self-paced* timing.
When we reach for an espresso cup the same theory must be applied. The action trajectory and within there the *tau*-value of the movement action ($tau^{G}{}_{MM}$) is shaped out of all places P of the outside of the fingertips. All places of the transition points P^T continuously remain very close to the outside of the fingertips but remain on the inside of the body and by doing so also form a line segment. In a practical sense this line aligns with the action trajectory[324] and will also end when the action trajectory ends. However the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) is created by the transition point trajectory and not by the action trajectory. So theoretically they remain different gaps but within a practical view one can see the two gaps as just one gap. The practically fill in the same line segment in the same way. That has the consequence that information about one gap automatically provides information about the other gap.
This means that you are able to stop the reaching for an espresso cup at any moment if you for example have to sneeze. The coming to a standstill of the gap within action trajectory ($tau^{G}{}_{MA}$) will cause the gap within the motoric movement ($tau^{G}{}_{MM}$) to also come to a standstill. When you resume the closure of the action trajectory gap the gap within the motoric movement (MM) will follow as well and will continue with the moving of the fingertips until the leading *tau*-value ($tau^{G}{}_{MA}$) approaches zero. If the preferably visual perception processes[325] perceive that the *tau*-value within the movement action

[323] This *tau*-coupling is also the explanation of the fact that if we perceive how the gap of the letter trajectory disappears we give the signal to the motoric movement (MM) to slow down as well. This has the consequence that bodily activity will come to a gradual stand still when the letter approaches the slit.
[324] In *catching* tasks the transition point trajectory is a completely different line segment shape. In these tasks *real* timing is involved.
[325] As earlier remarked in here we are able to auditorily time actions. The hitting of a nightly mosquito can also be seen as a Motoric Movement Action *touching*. If we hear and/or feel that the mosquito completes its action trajectory to a part of our body then we first shift our hand to a general position from where many escape routes of the mosquito can be intercepted and then subsequently close the action in a swift and *timed* way.

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($tau^{G}{}_{MA}$) approaches zero then the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) must be guided in such a way that it also approaches zero.
In the phase that the *tau*-value of the movement action ($tau^{G}{}_{MA}$) approaches zero the motoric movements will generally be slowed down in such a way that they gradually will fill the last part of the transition point trajectory. That means that if for example your hand needs to accelerate to the head of a nightly mosquito, which landed on your head, that beforehand it takes into account the whole, *precise global*, gap within the movement action ($tau^{G}{}_{MA}$). This takes care of the fact that your hand will not hit through your skull but will initiate/time the hit till the outside of the relevant place of the head. This will also take care of the fact that after the acceleration of the hand a deceleration will be added. Or with other words the motoric movement (MM) will be completely tuned towards the specific line segment between the hand palm and the outside of the head where the mosquito landed.

4. The complete Motoric Movement Action *grabbing/taking/touching etc.*

The description of the two only organs of the Motoric Movement Action can leave the suggestion that they are linear or otherwise separated processes. That is a misconception. Both organs are part of one undivided complex system. The explanatory model explains the Motoric Movement Action as a complex system. The description of the motoric movement (MM) and the movement action (MA) only concerns the explanation of the two complex subsystems. During the execution of a Motoric Movement Action they need to be executed simultaneously. The explanatory model explains which perception processes in both parts are needed and out of which perspective they need to be perceived. The explanatory model is connecting the processing processes of the perception to the movement action (MA) and proprioceptive perception to the motoric movement (MM) but it doesn't exclude that some perception processes show overlaps.
So when we want to grab an espresso cup the primary focus must be pointed at the action trajectory shape and at the same time the secondary focus must be pointed at the biomechanical main action towards the transition point of that action trajectory.
Both foci arise out of the obligatory simultaneous cooperation of bottom-up and top-down perception processes. That insight definitely ends the perception-action dichotomy within scientific debates. One can only get convinced of the *tau*-values within the movement action ($tau^{G}{}_{MA}$) and the motoric movement ($tau^{G}{}_{MM}$) if one will understand the exact origin. You are only able to depict a gap when you try to visualize a perceptual image of a latent line shape as sound as possible and take away the manifest part of the actual positions of the (movement) action object or the transition point within that perceptual image. The gaps follow each other as aforementioned. The leading gap is always created by the movement action ($tau^{G}{}_{MA}$). It is leading because the outside of the fingertip is the (movement) action object, forms the essence of the action and because we are not able to influence it. The *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) will have to follow because it executes the movement action (MA) and because we conversely are able to influence it in a proprioceptive way. The *tau*-coupling occurs during the whole action and also implies that and how both processes must be executed simultaneously.
When the *tau*-value of the movement action ($tau^{G}{}_{MA}$) approaches zero then the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) also will have to approach zero.
Of course it is important to know that and how the functional *tau*-coupling operates in even simple Motoric Movement Actions but in this specific action it just has little *functional* relevance.

5. The Motoric Movement Action *touching* of a desktop icon with a cursor

In this section I will appoint a specific example of the Motoric Movement Action *touching*. It can be seen as a further explanation of the universal character of the explanatory model but I especially use it in here to further illustrate the aforementioned *tau*-coupling and the transition point within the Motoric Movement Action *grabbing/taking/touching* etc.. When grabbing a coffee mug the transition point is situated immensely close to the (movement) action object and that can cause some ambiguity. The nice thing about this example is the fact that 1. you probably are sitting behind a computer right now

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and that you can experience the aforementioned processes right away and 2. that this Motoric Movement Action *touching* is executed with the help of a set intermediary constellation (a mouse). This set intermediary constellation will create a clear difference between the action trajectory and the transition point trajectory and that will take care of a clearer explanation of the *tau*-coupling.

If you want to touch a desktop icon with a cursor at a strange desktop or if you resume your work at your PC after a break then you first localise 1. the spot of the cursor and 2. the spot of the specific icon you want to touch. Right after these observations you create a perceptual image of a *precise global* action trajectory shape out of the perspective of that outside of the cursor that will touch the outside of the specific icon. In your opinion you create a straight line segment between the icon and the cursor. Because when there is *nothing* we preferably create straight, parsimonious, lines probably out of efficient and effective evolutionary evolved motives. This construction of a latent action trajectory shape is completely conform the aforementioned parts of the movement action (MA). The cognitive basis and the tactical movement action are responsible for this latent perceptual image.
Once this perceptual image is created the actual movement action starts in which you just throw the cursor in the beginning of that latent line segment shape. The processing processes of the perception now accompany the whole process until the cursor touches the icon. The *tau*-value of the movement action ($tau^{G}{}_{MA}$) is now shaped by how the manifest action trajectory fills the whole latent action trajectory shape. Or with other words we observe in here how the line segment, the gap, between the cursor and the icon is closed.
In essence the cursor will fulfil the egocentric formulated task but it can't execute anything by itself. If we don't touch the mouse the cursor will never start to move. The mouse is also a (motoric) movement object but as opposed to the before shown photo examples (spoon, tweezers, frying pan pincer) the mouse is not a flexible (motoric) movement object. The Motoric Movement Actions at a PC are characterized by the fact that a set intermediary constellation is involved. When a set intermediary constellation is involved that means that the transition point of this Motoric Movement Action is not situated in the flexible (motoric) movement object but is situated on the outside of it. So the transition point in here is situated *between* (!) 1. the outside of those parts of the hand that touch the mouse and 2. the outside parts of the mouse that will be touched by the hand. So when we move the mouse a trajectory of transition points is created on the mouse pad at a significant distance from the action trajectory shape at the desktop. The manipulating of a mouse over a line segment is a very simple task and we are completely able to execute that task in a proprioceptive way and the *tau*-value of the motoric movement ($tau^{G}{}_{MM}$) is now also created at a distance due to how the mouse fills a certain gap at the mouse pad.

In this example it is obvious to determine that we solely follow the cursor with direct vision and not the movements of the mouse. In essence the cursor executes the egocentric formulated task, determines the leading *tau*-value ($tau^{G}{}_{MA}$) and is part of the primary focus. The motoric movement (MM) must be executed simultaneously, executes the movement action (MA), determines the following *tau*-value ($tau^{G}{}_{MM}$) and is part of the secondary focus. If we visually perceive that the *tau*-value of the movement action ($tau^{G}{}_{MA}$) approaches zero, when the cursor is approaching the icon, then it gives a signal to the motoric movement (MM) to gradually slow down the movement of the mouse as well and let the gap *on the mouse pad* also approach zero. Without that strict *tau*-coupling we would always pass the icon first before we are able to return to it.

So this shows that there is also timing involved in this Motoric Movement Action. However it is *self-paced* timing. If we suddenly have to sneeze during the movement of the cursor or if you have to answer the telephone the two gaps stop simultaneously and will resume at the same time once you continue the action. Just like within the grabbing of an espresso cup.

6. The fluctuation boarders within the touching of desktop icon with a cursor versus the fluctuation boarders within the grabbing of an espresso cup

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The touching of a desktop icon with a cursor provides a perfect opportunity to review the fluctuation boarders within a Motoric Movement Action once more because it forms a clear contrast with the fluctuation boarders within the grabbing of an espresso cup.
In general one can state that the complexity of a Motoric Movement Action is also dependent on the fact between which fluctuation boarders deviations of the action trajectory shape can be covered within the motoric movement (MM). A sound understanding of this part explains completely why we have to accompany some actions to the end with direct vision and why and when we don't have to maintain that in other tasks. This is of importance because current scientific research concerning daily activities (Hayhoe, Land, Foulsham) concludes that one can transfer gaze to the next script-item a considerable time frame before the current task is fully completed in mainly grabbing tasks. However the right explanation is not appointed in that scientific research.
In daily activities in for example a tea making task (Hayhoe, Land) we grab a lot of script-items with the hand in which we indeed are able to transfer gaze long before that current task is finished. That leads first of all to the preposition that a next script-item must be available and besides that to the preposition that a kitchen usually provides a *safe* environment[326]. Or with other words a kitchen usually contains a lot of *nothing*. If the situation complies to these prepositions we indeed are able to transfer gaze long beforehand because the fluctuation boarders of the hand opening are able to cover possible deviations of the *precise global* action trajectory shapes in daily grabbing tasks in a 1:10 or maybe 1:20 ratio. If I want to grab an small coffee cup then the hand grip fits between the relevant fingers so many times that I am even able to comfortably cover large deviations of the action trajectory shape within the fluctuation boarders of my grabbing technique. A lot of daily actions comply to this explanation as well and it is also valid in lots of actions in a tea making script (grabbing teabag, grabbing cup, opening cupboard, grabbing kettle etc.).
Conversely this is not possible in Motoric Movement Actions in which the fluctuation boarders of the motoric movement (MM) hardly are able to cover deviations of the action trajectory shape. As examples in here I appointed the Motoric Movement Action *needle and thread* and the Motoric Movement Action *opening a keylock* in addendum two. Usually we need to accompany these actions with direct vision till the very last end.
The touching of a desktop icon with a cursor widens the explanation of this all. Because a set intermediary constellation is involved we approach the desktop icon just by means of the mouse. This takes care of the fact that we are not able to receive any haptic/proprioceptive feedback of how the cursor approaches the icon and that is why we usually need to observe the whole action path of the cursor with direct vision till it finally touches the icon. So in short when a set intermediary constellation is involved then we are not able to feel/note any fluctuation boarders at all and one will not be able to transfer gaze beforehand to a next script-item[327].

[326] Please take my word for it that if there is a working chain saw present in a small kitchen area you will observe every part of every action with direct vision and will never transfer gaze beforehand.
[327] This is also the case in the Motoric Movement Actions *biking, car racing etc.* which are executed by a set intermediary constellation (bike, car). In those actions we don't get any feedback by the motoric movement (MM) about the status of the action trajectory shape.

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Appendix E – The Motoric Movement Action *cat and mouse game*

1. Introduction
2. The movement action (MA) of the incoming melon trajectory and outgoing *melon* trajectory – The primary focus
3. The motoric movement (MM) of the incoming melon trajectory and outgoing *melon* trajectory – The secondary focus
4. The complete Motoric Movement Action *cat and mouse game*
5. The optimal strategy within the Motoric Movement Action *cat and mouse game*

In this appendix the old-Dutch cat and mouse game will be appointed as a Motoric Movement Action. It will serve as an illustration of the Motoric Movement Action in general. Each Motoric Movement Action will pass the explanatory model in a consistent universal way. By doing so the explanatory model provides full transparency in all functional processes. Because of that we are able 1. to appoint the complexity of a single Motoric Movement Action, 2. to classify all Motoric Movement Actions concerning their complexity and 3. to formulate an optimal strategy within the execution of each Motoric Movement Action. The aforementioned will lead to the possibility to formulate an ending set description of a learning progression and will *automatically* lead to the most optimal learning model. The cat and mouse game in here is also assessed because of its relationship with sports like tennis, cricket etc.. These sports are one of the main subjects in addendum two. It also serves as an example to show that once you are familiar with all the relevant processes you are able to plot an optimal strategy because practitioners of this game most often show a tactical approach which has no overlaps whatsoever with this optimal strategy.


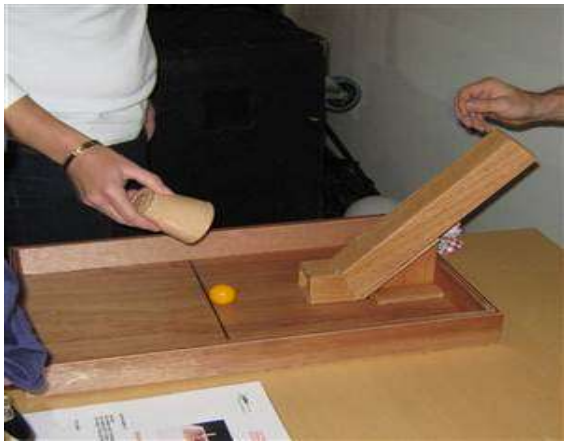

Image: The original old-Dutch *small version* of the cat and mouse game. Observe the obvious commonalities with a set classic marble run.

1. Introduction

The Game Idea of the Motoric Movement Action *cat and mouse* game is to catch a rolling ball which approaches you through a non-transparent (!), diagonal assembled, tube. The incoming ball needs to be caught with the help of a cup before or on a set marked line,. The diameter ratio *cup-ball* must be around 3:2[328]. However this is the original old-Dutch cat and mouse game and although it provides the

[328] The complexity of a Motoric Movement Action is also based on the fact if and how a (movement) action ob-

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name to this appendix I will appoint a variation of this game in here. I will appoint *the bigger version* in which a large PVC tube, melons and a baseball bat are being used. The goal in the last phase of this game is not to catch the melon but to *smash* the melon with the bat. In Holland this game can be spotted at our national King's/Queen's days[329] and it became well-known due to a popular children television program called: "*My father is the best!*". But all the principles stay the same[330].
I chose *the bigger version* because the (movement) action object (the melon) needs to be smashed to pieces at a set spot in the last phase of the action. The appointing of this variation will show a very nice transition to all hitting sports in general. The understanding of all the functional processes within this game will serve as a basis to later understand the far more complex processes within for example the Motoric Movement Actions within cricket or tennis.

Image: *The bigger variation* of the cat and mouse game. The melon must be smashed between the two blue lines[331].

The traditional design, *the smaller version*, of the cat and mouse game can only be related to the Motoric Movement Action *catching*. The bigger version also tends to that action but also tends to combined catch and throw actions which are more complex. Actions we know from sports like tennis, cricket, baseball, table tennis, badminton etc.. The melon not only needs to be stopped but also needs to be smashed to pieces. That doesn't lead to many tactical deliberations but in the end phase of this action it must lead to the fact that the bat will have to provide such a pressure on the melon that the melon will collapse due to that pressure or in combination with the counter-pressure of the table. If one would regard this as a combined catch and throw action then one could say that an incoming horizontal *melon* trajectory needs to be caught optimally and directly linked to a vertical outgoing *melon* trajectory into the table. Or with other words the melon needs to be hit dead straight through the table[332].
The difference with *the small version* concerns the fact that the hitting bat must be kept at a distance and needs to be accelerated to gain sufficient energy to fulfil this task successfully[333]. Conversely the

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ject fits into the fluctuation possibilities of the motoric movement (MM). You are able to clearly see the complexity change if we were allowed to catch the ball with a big *moving box*. Then all deviations within the action trajectory would easily be covered by the wide borders this specific motoric movement (MM) will provide. Also see addendum 2.?: The fluctuation possibilities within the needle and thread task and the key in lock task.

[329] On the birthday of the Dutch king/queen the citizens organise flea markets with performances, life music, games etc...

[330] The game is just magnified with a factor ±30 (?). See the illustrations. The tube has a diameter of ±30-40 centimetres and is ±4-5 metres long.

[331] Belonging to this YouTube video clip: https://www.youtube.com/watch?v=arsBG_QvPm8&t=8s.

[332] The fact that the incoming melon trajectory and the outgoing melon trajectory make a square angle is a complicating factor. This complicating factor could equal the horizontal grabbing action with the hand of the vertical falling sticks in the old-Dutch *stick catching game* (See appendix B: The Motoric Movement Action *catching*).

[333] The involved hitting bat distance will have to provide such energy that the melon will collapse. This fact

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single task to just catch a ball with a cup can be approached evenly and therefore must be classified as a much less complex task. If one would compare *the bigger variation* of the cat and mouse game, as a linked catch and throw action, within the whole range of linked catch and throw actions then it is one of the most simple actions. The incoming *ball* trajectory and the outgoing *ball* trajectory always describe the same shape.

So the task out of an egocentric formulated will within *the bigger version* of the Motoric Movement Action *cat and mouse game* is to catch a melon which will approach us and directly smash it to pieces. So two separate Motoric Movement Actions are involved in which the action trajectories need to be linked to a (mini) chain or a *cycle*[334]. The ending of the action trajectory within the catching is forced to be the beginning of the action trajectory within the throwing. The role of the motoric movement (MM) within that process is very complex. The catching and the throwing, the receiving and the sending, are optimized by many conflicting motoric movements (MM). The catching benefits from a stable, static, standing still motoric movement (MM) and the sending benefits most from the transfer of as much energy as possible like for example in the modern era of today's power tennis. So within technique training one needs to address these two interests and one will have to look for an optimization because both must be merged. On the job this will most likely lead to the adjustment that in the first stages of the receiving the emphasis will be put on the catching process until the chance to deviations is minimized and then the attention is being transferred to the throwing process. So it is important to determine that the optimization of one process is detrimental to the other process and that one needs to look for the best possible compromise.

The primary focus within the catching as well as the throwing must be pointed at the action trajectory out of the perspective of the melon. The melon will shape the action trajectories and nothing else. The melon is a completely autonomous entity. We are not the melon and we will never be able to control it in any way[335]. That is why our visual perception processes mainly need to be occupied with all the places P of the melon trajectory in order to be able to draw conclusions concerning near future places of the melon. That is the only possibility to manage that part of the Motoric Movement Action. However the melon doesn't do anything on its own. Without the melon we obviously are not able to execute this action but if we don't pick up the hitting bat nothing will be caught, hit or deviated from its direction either. If we want to catch a melon and finally want to change its direction then we are only able to do that by making movement trajectories within our body which we conversely do control.
Catching/receiving is only possible if we keep the primary focus on the incoming melon trajectory and simultaneously keep the secondary focus on the movement trajectories within our body which have to execute the catching. Throwing/sending/hitting is only possible if we keep the primary focus on the initial phase of the outgoing melon trajectory and simultaneously keep the secondary focus on the movement trajectories within our body which have to execute the throwing/sending/hitting.
The secondary focus within the catching as well as the throwing must be pointed at the transition point towards the action trajectory. The transition point in this Motoric Movement Action is situated between the outside part of the hitting bat that will touch the melon and the outside of the melon that will be hit by the bat[336].

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needs to be optimized. A melon is a sturdy fruit and doesn't collapse easily. So the bat needs to be removed far from the hitting area but that has a direct consequence for the time frame in which the motoric movement (MM) can be executed (Δt_{MM}). In an optimal strategy one has to search for a starting point of the bat which will provide sufficient potential energy but will minimize this time frame.

[334] In tennis the main goal on the one hand is to create chains of (many) ball trajectories. At a micro level coaches need to study parts of these chains. Like in baseball, cricket etc. the study of one incoming ball trajectory and the linking to one outgoing ball trajectory needs to be payed attention to. This special part of a chain is called a *cycle*.

[335] The direction of the water in a mountain stream can only be changed by the *indirect* shifting of rocks. We are able to influence the direction of matter but we will never be able to control matter.

[336] So before the bat touches the melon the transition point can be appointed out of two perspectives. From the

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Probably you will find that hard to understand. You probably already had a certain scepticism about the fact that two Motoric Movement Actions are involved which don't have any relationship concerning the involved line shapes. As well the line shapes of the action trajectories as the movement trajectories. Besides that it is hard to understand that in each separate Motoric Movement Action two foci are involved. Although a few people have some difficulties in using a hitting bat the hitting technique remains fairly simple for most people in such a way that they don't notice that they pay attention to the technique or the movement trajectories within the body. They have combined the two foci in both Motoric Movement Actions to one complex focus image and are able to completely focus on the line shape of the melon trajectory. So it seems that we are able to influence the movement of the melon 1:1 but that is not so.

2. The movement action (MA) of the incoming melon trajectory and outgoing melon trajectory – The primary focus

The explanatory model of the Motoric Movement Action appoints three parts within the movement action (MA). The cognitive basis, the tactical movement action and the actual movement action. Within the usual catch and throw actions the first two parts are immensely active to narrow down the perceptual image of the incoming object trajectory and to link it with an outgoing object trajectory with an optimal game intention. In the cat and mouse game there is no need for that process. The incoming ball trajectory is now literally a set, classic, marble run in which one is not only able to create a precise perceptual image of a global action trajectory but is able to create a precise perceptual image of a precise action trajectory. The outgoing ball trajectory is also obvious. At the hitting spot one needs to create an initial phase in which the melon will be hit into the table at a square angle to the table. So the tactics are already defined in a fixed pattern and the complexity of the Motoric Movement Action is therefore not situated in this part. It even contrasts heavily with the comprehensive tactical deliberations within for example tennis, cricket etc. and that mainly defines the discrepancy in complexity between these actions.
The complexity of this movement action (MA) is situated in the actual movement action. As aforementioned we not only create a more precise perceptual image of the action trajectory shape every time frame during the actual movement action but we also create a more precise image of the involved time frame in which the action object will fill in the latent action trajectory. We don't achieve this by very complex calculations but one is able to achieve this in a very simple way by just comparing the manifest part of an object trajectory with the whole, the manifest and latent part of the, action trajectory[337]. The way in which that gap is filled will provide the *tau*-value of the movement action ($tau^{G}{}_{MA}$). Determining this *tau*-value ($tau^{G}{}_{MA}$) is essential because it is leading and determining how the gap within the motoric movement ($tau^{G}{}_{MM}$) simultaneously needs to be closed. This simultaneous closing of both gaps is needed in order to let the *tau*-coupling succeed.

But the determining of the *tau*-value of the movement action ($tau^{G}{}_{MA}$) is the main problem within this Motoric Movement Action. We are able to create a perceptual image of the latent action trajectory but we are not able to create an actual visual relationship with the actual place of the melon. And that is essential for determining the *tau*-value of the gap[338]. The establishing of a *tau*-value in this Motoric

part of the bat that will touch the melon towards the melon and from the part of the melon that will be hit towards the hitting bat. It is essential that you understand that the gap of the motoric movement ($tau^{G}{}_{MM}$) is situated between these two perspectives. Between these two points the transition point trajectory is created. So when these two perspectives eventually merge then the gap between the two approached zero and the *tau*-coupling must be completed.

[337] Although the term *time frame* seems to imply that time is involved the *tau*-value is mainly determined by differences in space.

[338] We just create visual relationships within all Motoric Movement Actions and have scarcely trained alternative strategies. If it would be very quiet and the rolling melon in the tube would provide sufficient noise then we would be able to establish the filling of the gap auditorily. That is also the method how we determine the action trajectory towards the head of a nightly mosquito. But out of the fact that we only are able to hit nightly mosqui-

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Movement Action can only start when the melon will finally become visible almost at the end of the action trajectory when the melon emerges from the end of the tube. Without a modified strategy most people will then try to observe the initial phase of the visible part of the action trajectory with direct vision in order to still establish a *tau*-value of the closing of the gap of the melon trajectory. If you want to establish a sufficient quality within that observation then that will take a certain amount of time. If we then continue with the script of the normal Motoric Movement Action *catching* then a saccade of the eyes will follow towards the hitting spot where we normally will wait for the approaching ball out of peripheral vision. This saccade also takes time. Both time frames are pressurized because there is only a little distance left in which this all need to be observed and the melon will soon appear in the hitting zone. The complexity of the movement action (MA) is situated in this phase.
Out of absolute values one is able to determine which melon velocity and which distance (end tube to hitting place) will just not provide enough time to create a *tau*-value and accordingly a transfer with a saccade. When the velocity is too high or the distance too short then there will just be not enough time for the obligatory actions to be executed by the motoric movement (MM).
When time conversely will remain then one needs to link the *tau*-value of the perceptual image to the *tau*-interval of the movement trajectory out of the perspective of the transition point in that very small time frame. But this Motoric Movement Action will always be pressurized because in a small time frame one needs to establish a *precise global* image of the *tau*-value of the movement action ($tau^{G}{}_{MA}$).

3. <u>The motoric movement (MM) of the incoming melon trajectory and outgoing melon trajectory – The secondary focus</u>

The movement idea within every motoric movement (MM) must be appointed out of the biomechanical unity model[339] because the unity model approaches all motoric movements, the technique, within one Motoric Movement Action as a complex system. However a full description out of the perspective of the unity model would take too much room in here and so I limit myself to a partial description.

The hitting bat enlarges the motoric movement (MM) with one extra movement trajectory. The bat is a flexible (motoric) movement object and not a set intermediary constellation. A movement model needs to fully incorporate this extra movement trajectory as part of the unity model. Because the hitting bat is a flexible (motoric) movement object the transition point (contact point) is situated on the bat. Just like in baseball one will hold the bat with two hands and situate the transition point between 5-40 centimetres below the top of the bat. Also like in baseball one will take a sideways position, with a square angle to the hitting area, towards the incoming melon trajectory. Except for the arms the body will have to form a rigid unity in such a way that the arms will be able to move the hitting bat optimally. The bat will mainly be moved by the cooperation of antagonistic muscle groups in the arms (adduction-abduction of the upper arms, flexion-extension of the elbows etc.). Maybe it is unnecessary in here to mention but I want to emphasize that the *whole* body, out of the perspective of the unity model, from the beginning to the end is needed for the execution of one motoric movement (MM) and is completely serving the execution of one specific action trajectory within the respective movement actions (MA).

Before the melon is tossed a batter already defined a (distance-)position to the hitting area[340]. Based on cognitive knowledge an experienced batsman is familiar with the fluctuation borders considering *the length* (arm connected to a hitting bat) of the movement trajectories which are involved during the biomechanical main action towards the transition point. Based on this information the batter will take an

tos successfully once they are very close to the head we are able to deduct that observing the gaps auditorily contain a major error rate and isn't the predilection within human behaviour.
[339] See: *Caught In A Line*; p.100.
[340] See also the *stance/feet position* determination in the Motoric Movement Actions *letter posting*, *catching* and *grabbing/taking etc.*.

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easy feet position not too close and not too far away from the hitting area[341]. That will also provide the biggest possibility to maximally cover occurring deviations within the melon trajectory. That makes it possible that even melons that deflect towards or from the batsman can be hit successfully. This process comprises one of the essences of successful executions of Motoric Movement Actions. A successful execution demands that the fluctuation possibilities within the motoric movement (MM) must be able to cover occurring deviations within the action trajectory. Within the determination of the feet position a batsman chooses such a position in which the catching as well as the throwing can be optimized.

An experienced batter will also be able to create a, *precise global*, perceptual image of the line shape that all transition points P^T of the hitting bat will create during the actual hit[342]. Most people will approach this Motoric Movement Action by bringing up the bat in a straight line right above the hitting area and when it is needed bring the bat down in a straight line[343]. So they also create a perceptual image of this line shape first and they *actually* will fill the gap with proprioceptive perception processes. In that way we are also able to establish a *tau*-value of the motoric movement ($tau^G{}_{MM}$) just like within the movement action (MA). By the way this gap is already acknowledged in scientific research (Lee, Craig et al.). But the explanatory model refines this acknowledgement 1. by explaining that this is the *following*, not-dominant, *tau*-value of the leading *tau*-value within the movement action ($tau^G{}_{MA}$) and 2. by explaining that this following *tau*-value ($tau^G{}_{MM}$) needs to be appointed more precisely out of the perspective of the transition point.
The complexity of the motoric movement (MM) however is not caused by the *tau*-value like in the movement action (MA). The *tau*-value of the hitting bat can be determined quite well and is only pressurized because the *tau*-value within the movement action ($tau^G{}_{MA}$) can't be established sufficiently. The complexity of the motoric movement (MM) within the Motoric Movement Action *cat and mouse game* is determined by the fact that the catching must be linked directly to the throwing and that the movement shapes in this specific action literally make a square angle. The catching process of a horizontal approaching melon is optimized by a hitting bat that will show an opposite horizontal catching shape. Conversely the throwing process is optimized by a hitting bat that will show a vertical shape towards the melon/hitting area. These are shapes that don't fit together well in one technique. Optimization of this process will have to lead to a compromise of the two. In this task one definitely needs to look for an optimal catch/throw technique. As aforementioned the catching is pressurized and will need lots of attention but the hitting bat will also need to possess lots of potential energy if it wants to hurt the melon in any way.

[341] This is also conform all Motoric Movement Actions which demand a choice for a feet position after an inevitable leg movement/relocation A-B. In for example the kitchen we are obligated to constantly make a few steps then to the fridge and then to the cupboard in the left upper corner. We know exactly how close we have to get to reach for the milk standing at ground level in the back of the fridge and for that big saucer pan in that cupboard hidden away behind three other pans. Because we know exactly which *precise global* borders within the arm length are involved. This fact is a serious indication that these kinds of Motoric Movement Actions can never be executed with the sole help of online perception processes.
[342] To differentiate the places P within line shapes I chose P for the action trajectory within the movement action (MA) and P^T for the transition points or the movement trajectories within the motoric movement (MM).
[343] See the previous photos of *the bigger version* of the cat and mouse game.

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Image: It is remarkable that we approach these actions solely out of the hitting and not at all out of the catching. When asked you would also approach this action in this way when you are not aware of the optimal strategy in the upcoming explanation. And so you also, like most others, will try to hit the melon as hard as possible in a perpendicular line downwards and consequently you will also miss the melon by a mile and so this image can only be produced when we place a melon statically at a scaffold.

4. The complete Motoric Movement Action *cat and mouse game*

The description of the two only organs of the Motoric Movement Action can leave the impression that they are linear or otherwise separated processes. That is a misconception. Both organs are part of one undivided complex system. The explanatory model explains the Motoric Movement Action as a complex system. The description of the motoric movement (MM) and the movement action (MA) only concerns the explanation of the two complex subsystems. During the execution of a Motoric Movement Action they need to be executed simultaneously. The explanatory model explains that perception processes are needed in both parts and out of which perspective they need to be perceived. The explanatory model is connecting the processing processes of the visual perception to the movement action (MA) and proprioceptive perception to the motoric movement (MM) but it doesn't exclude that some perception processes show overlaps.
So in the cat and mouse game the primary focus must be pointed at the melon trajectory shape (MA), in this exceptional case a set marble run, and at the same time the secondary focus must be pointed at the biomechanical main action within the hitting technique (MM) towards the transition point of that melon trajectory.

On the outside it looks so simple but in fact there is a very complex process going on. In this game you simultaneously create two perceptual images of *precise global* latent line shapes. One of the melon and one of the hitting bat. Based on years of practice experienced hitters tactically choose one of the possible intersection point options and align the line shape of the hitting bat towards the line shape of the melon. Just a minor part of the line shape is concerned with establishing a *tau*-value within each of those line shapes. In both processes we achieve a *tau*-value by perceiving the actual place of the melon and the hitting bat and by doing so strike out the manifest part of the line shape against the still latent part of the perceptual image. The remaining opening is then the gap which still needs to be filled. The filling of this gap, the speed in which it is filled, will provide a *tau*-value which will finally have to approach zero in both line shapes at the end of the execution of one action. So the gaps are being filled in the same way but the perception processes are essentially different in both line shapes. We usually perceive the closing of the *melon* gap visually and we perceive the closing of the *hitting bat* gap in a proprioceptive way.
If we actually want to hit something in batting sports then we will have to synchronise the *hitting bat* gap towards the *melon* gap because we are able to influence the first gap and not the second one. The explanatory model appoints this as the *functional tau*-coupling, it is present in all Motoric Movement Actions and in here will have to take care that when the *melon* gap approaches zero the *hitting bat* gap needs to approach zero as well. Although I want to remind in here that the *tau*-coupling is just a one-dimensional component within a much more complex process in which the shape of the hitting bat trajectory also must be synchronized with the shape of the melon trajectory. You can simultaneously close all the gaps you want but if you don't close the gap with an optimal shape and don't close it at the exact same spot it all makes no sense. This more comprehensive synchronisation also displays the coupling of the primary focus to the secondary focus.

The full description of this very complex process will give a definite place to a lot of related issues and will solve and end a lot of problems and debates. It is very important that one understands that an optimization process is involved that happens again and again anew and that one understands that it is not one set process which you for example can learn by heart. When I execute a letter posting task it always succeeds but it remains an optimization process. That means that each time, again and again, I will have to narrow down the fluctuation borders of the motoric movement (MM) in a unique way and

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that not one letter delivery will ever be the same. However because we always manage to post the letter it seems there is a set process involved but also in this task there is an error rate. Within healthy people the error rate in a letter posting task is zero or nihil because all possible deviations can be easily covered within the wide-ranging fluctuation borders off the specific motoric movement (MM). So within the Motoric Movement Action *cat and mouse game* there is also a unique optimization process involved and because the deviations in there can't be covered easily within the fluctuation borders of the specific motoric movement (MM) the error rate is never zero or nihil[344].
Besides this the *perception-action* dichotomy will be ended. Or to put it even stronger the explanation of the origination of a *tau*-value involves the obligatory coupling or the obligatory cooperation of a perceptual, near-future, image with an actual image. So there is an obligatory *perception-action coupling* within each of the functional *tau*-values within every Motoric Movement Action and those *tau*-values together shape the *functional tau*-coupling.
In retrospect it will also become very clear that The Quiet Eye (TQE; J. Vickers) was a very naïve linear explanation for the many active perception processes and that *gaze* indeed was the effect and definitely not the cause of those many perception processes. Now it becomes clear that experienced players are just able to perceive all the relevant variables very quickly and execute it very fast accordingly.

5. The optimal strategy within the Motoric Movement Action *cat and mouse game*

Now that all functional processes are clear it is possible to appoint the optimal strategy within the Motoric Movement Action *cat and mouse game*. I will limit myself to two matters. They are exactly the two matters which only a select group of elite players in many real sports have completely implemented into their elite game. In the future new upcoming elite players will have to completely implement these strategies in the same way.

a. The *tau*-value determination within the movement action ($tau^{G}{}_{MA}$)

Like aforementioned the complexity of the movement action (MA) is situated in the fact that one isn't able to establish a sound relationship between the actual place of the melon and the latent action trajectory shape and subsequently to complete a saccade to the hitting area. That all takes time and that time frame is the major problem in here because the melon approaches the hitting area with a *pressurizing* speed[345]. But even so all practitioners of this game will execute the involved actions as within the *normal* Motoric Movement Action *catching*. So we first look at the end of the tube with direct vision, subsequently we want to establish a *tau*-value and then we make a saccade to catch the melon in the last phase. However the difference with normal catching is based on the fact that within normal catching we would already have established a *tau*-value with direct vision long before the melon actually appears at the very last moment. In *normal* catching we are able to establish a *tau*-value from the first moment a (motoric) movement object is thrown and we are able to gradually align this with our motoric movement (MM). So in normal catching we are able to make a saccade in a gradual and comfortable way and wait till the melon approaches the hitting bat out of peripheral vision.
Clearly we are not able to execute that all in here but luckily within this Motoric Movement Action we exactly know where the melon will appear and which set action trajectory shape it then is going to follow.
That is why we are able to aspire to get rid of the saccade within the whole process. So from the first moment we should try to observe the hitting area with direct vision and we should observe the end of

[344] This whole observation is for example very important for practitioners of every batting sport to develop a realistic approach. In tennis for example one is able to witness a lot of frustration concerning errors. That is also due to the fact that coaches with their coaching methods leave the impression that one is able to play the game without errors or with a very high success rate. Conversely future elite tennis players will have to learn that even if they do everything *right* that things can go wrong due to this optimization process. If they would accept that things *naturally* can go wrong at any moment then they would accept this a lot easier during matches and by doing so they wouldn't allow frustration to take over. An elite player needs to learn that there is a set relationship between ball trajectory shapes, game intentions and success rates.
[345] Why don't they let you hit a home run in a relaxed way?

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the tube with peripheral vision and in that way determine a *tau*-value of the incoming melon trajectory.

It is essential in that process that we allow the melon to come to the hitting area and let the melon come to the hitting bat although the bat is moving. We are able to achieve that if we beforehand pick a clear latent intersection point of the latent incoming melon trajectory with the latent hitting bat trajectory. This strategy exactly represents the last phase in normal catching with the exception that we were not able to establish a *tau*-value yet. So within this alternative strategy we allow ourselves to fulfil the last catching phase in a normal way in which we just have to quickly catch up the determination of that *tau*-value on the side.
With this modification the catching process in this Motoric Movement Action is emphasized much more and this will be new and disappointing for the people, a little tipsy after a few drinks on our king's birthday, who are only interested in hurting the melon as much as possible with a magnificent smack. And not only for those people but also for beginners to even a few pro players in tennis and cricket who are mainly occupied with sending the ball. Because the essence within this strategy is only fully implemented by just a minor part of the elite player population. They are the few persons who probably in an implicit way have learned that the catching process at least should get as much attention as the throwing process deserves. So it is important in here that you see the overlap between the strategical adjustments within this game and the receiving strategy of elite players within for example tennis and cricket. In which must be remarked that those elite players within these sports still have the time to shape a *precise global* image of a *tau*-value of the incoming ball trajectory ($tau^{G}{}_{MA}$) and are able to execute a saccade. But they make the saccade much sooner than non-elite players and then turn to the aforementioned strategy.

"For example, Land and MacLeod (2000) measured eye movements in cricket, and found that batsmen anticipated the bounce point of the ball by a few hundred ms, and more skilled batsmen arrived at the bounce point about 100 ms earlier than less skilled players. These saccades were always preceded by a fixation on the ball as it left the bowler's hand, showing that batsmen use current sensory data in combination with learnt models of the ball's motion to predict the location of the bounce. This suggests that eye movement patterns are shaped by learnt internal models of the dynamic properties of the world."[346]

b. <u>The dualism within the motoric movement (MM)</u>

As aforementioned the complexity of the motoric movement (MM) is mainly determined by the fact that a horizontal approaching melon benefits most from a horizontal catch *counter*-movement and that the sending/throwing benefits most from a square angled vertical movement trajectory of the transition point within the hitting bat. But the two separate Motoric Movement Actions must be linked directly and so the motoric movement (MM) of the sending must immediately follow the motoric movement (MM) of the receiving.
If one would respect this dualism then one has to search for a *hitting* technique that optimizes both parts because one is easily able to establish that bringing the hitting bat up and down in a straight perpendicular line only optimizes the sending. Still this is the mindset of every practitioner of this game at first. That is why another name for some ball sports is *hitting* sports. They never use the term *catching* sports. And in retrospect it is very likely that in there the origin houses of the determining fact that so few people find the way of the optimal catching.
Probably a few techniques could lead to optimization but in here I only will appoint one technique as an example. If it would be mandatory to start straight above the hitting area then one shouldn't bring the hitting bat down in a straight line but in the shape of one third (⅓) of a round circle with the opening of the circle towards the end of the tube. The longer distance will provide more energy but the main purpose of this shape is that the last phase will approach the melon more horizontally. That will

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generate many more intersection points with the action trajectory. So in general one needs to look for a movement trajectory as horizontal as possible in the last phase but one which will still encapsulate the possibility to crush the melon between the bat and the table.

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