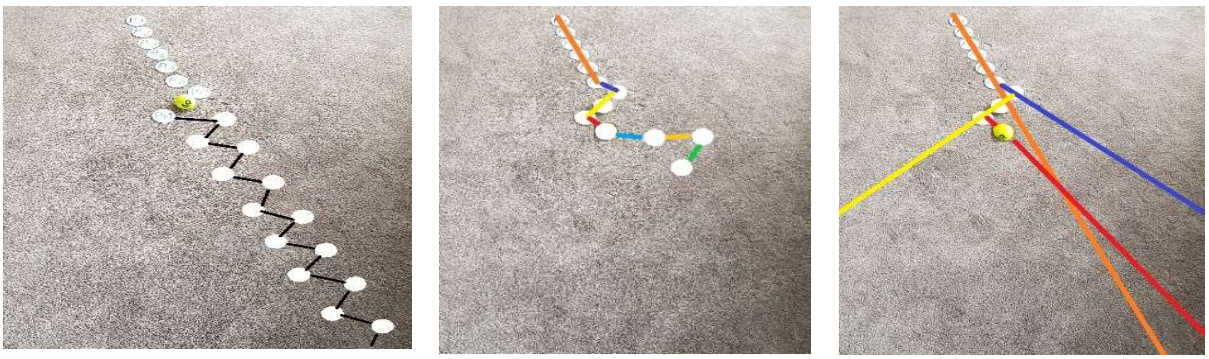
The complete and final clarification of catching – The cortical streams mediate a demarcation process during the catching of a ball



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

N.J. Mol
June 2022 ©

Introduction

The explanatory model of all motoric movement actions encompasses the clarification of all motoric and perception processes within every imaginable motoric action at the functional c.q. the behavioural level. The clarification compels a complex dynamic system, introduces lots of novae and saw the light medio December 2016. However science is not accepting it and for that reason very short articles are produced to further explain the most important principles of the presented complex considerations since the beginning of 2021. By assessing the principles in isolation as much as possible it is the goal to at least establish breakthroughs at sublevel which could possibly lead to recognition of the complete explanatory model.
The series started with four very short (root) articles[1] in which is disclosed how the functional perception processes in a set universal way are involved within all catch actions[2]. The series compels three articles with a very concrete environmental object[3] and in addition a fourth article clarifies that the auditory perception in relationship to the catching of words[4] (as in listening) encompasses an exact similar catch process[5].
One of the many important novae sprouting from all four articles concerns the fact that within a perceptual image every moving environmental object at *the actual moment*[6] (!) is present at the front position of the manifest line segment shape[7] c.q. shapes a perceptual image of the newest manifest position of the environmental object at the actual moment. Within which an other novum encompasses the fact that the latent part of an action trajectory shape compellingly sprouts from the manifest part of the action trajectory shape[8]. Which reveals that due to obtained cognitive knowledge it becomes possible to construct *precise global* perceptual images of still latent positions P of the environmental object and that forms the sole reason why we are capable to *prematurely* (!) anticipate to future situations[9].

---

[1] The complete and final clarification of catching - All motoric actions encompass interceptive tasks - The catching of a ball, The complete and final clarification of catching - All motoric actions encompass interceptive tasks - The catching of an approaching car, The complete and final clarification of catching - All motoric actions encompass interceptive tasks - The catching of an approaching foot en The complete and final clarification of catching - All motoric actions encompass interceptive tasks - The catching of sounds/words

[2] The explanatory model shows unambiguously that our perception-*system* factually always needs to be standby to assess all environmental objects for their movement or direction of movement. Which shows that we need to catch each and every time frame because we never will know when for example a lion is going to approach us. In which the catching in this case must be seen within the principle of "fight or flight". Which is accompanied by the very important remark that within flighting the catching process is as active and executed in the exact same way as the for example the catching of a ball. The latter principle is shown in a sport like dodge ball.

[3] An incoming ball within all ball sports, an approaching car within all daily traffic situations and an approaching hand/foot within all combat sports.

[4] The catching of words compels most of our listening. But we also catch a lot of sounds continuously. The article about the auditory perception processes compels the catching of a yell consisting of abstract sounds. It shows the exact same universal principles.

[5] This article also shows instantly the overlaps with speaking, blowing and writing due to which it covers the whole spectrum of motoric actions in which auditory perception processes play an essential role.

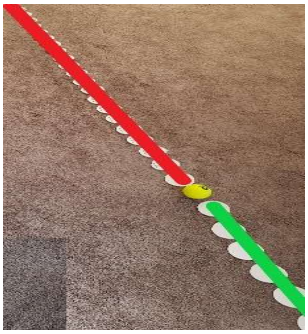
[6] P (0) or *t* (0).

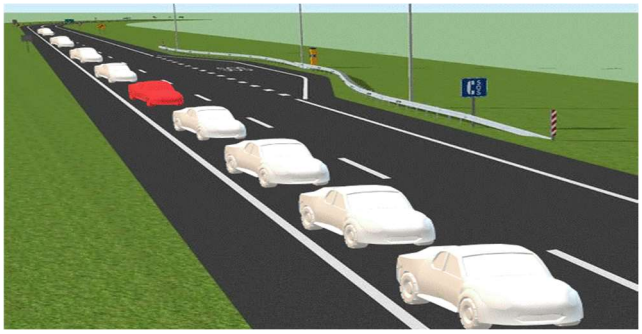
[7] This position can be called P (0) and is always accompanied by its neighbours P (-1) and P (+1). Or to be more precise the perceptual images P (-1) and P (+1).

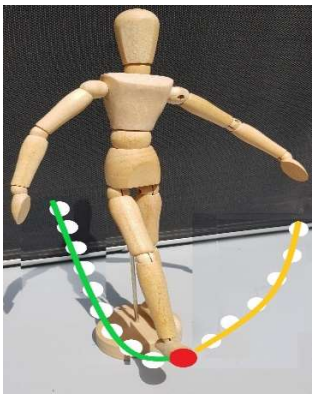
[8] Whatever you (or your body) will do in live all the positions of your body will construct just *one* (!) uninterrupted chain of body positions from birth till death.

[9] Due to this reason Roger Federer is certain about sprinting to the backhand or forehand corner just after a meter of the manifest incoming ball trajectory shape. Lots of aspects will remain uncertain till he finally hits the ball but the *direction* (!) of an incoming ball trajectory is an autonomous part of the shape and is revealed in a very early phase of the motoric action. (As a tennis coach I have never witnessed a ball landing in the backhand corner which was obviously hit to the forehand corner.)

Mainly due to the aforementioned explanation the (root) articles clarify for the very first time in the history of the movement sciences how the perception is linked to the action. In which in a superlative degree can be added that the explanation doesn't just compel a non-binding alternative which can be followed when one chooses to do so. Conversely the explanatory model of the motoric movement action clarifies unequivocally that within any imaginable motoric action the perception must be linked to the action in that specific way and even states that without each other they are totally meaningless phenomena. Because the explanatory model shows that the perception of the action c.q. the perceptual image of the action will never obtain any meaning if it isn't embedded within perceptual images of manifest and (still) latent time-fragments c.q. if it isn't embedded within perceptions of former and future actions. The actual action compels such a brief moment in time that it can only get meaning if perceptual images of adjacent time-fragments are added c.q. it can only get meaning by adding (recent) earlier and (recent) future perceptual images of the actual action.







t (0)	*t*(+1)	*t*(+2)	*t* (+3)	*t* (+4)	*t* (+5)
"Tam"	Tam	Tam	Tam	Tam	Tam
Ta	"Ta"	Ta	Ta	Ta	Ta
Te	Te	"Te"	Te	Te	Te
Re	Re	Re	"Re"	Re	Re
Ram	Ram	Ram	Ram	"Ram"	Ram
Pam	Pam	Pam	Pam	Pam	"Pam"
…..	…..	…..	…..	…..	…..
Tam	Tam	Tam	Tam	Tam	Tam
Tam	Tam	Tam	Tam	Tam	Tam

Images: The four images clearly show the action-perception relationship within each of the mentioned (root) articles. Within the perception of an incoming ball trajectory, an approaching car or foot and even within the perception of approaching words perceptual images are constructed of manifest actual action moments from which the perceptual images of the still latent positions P compellingly will have to sprout. The two kinds of perceptual images are always exactly separated by the perceptual image of the actual action moment. This actual action moment is highlighted with the colour red when the car, the foot or the words are involved. Within the image of the incoming ball trajectory shape you see the tennis ball at the actual action moment. In which this actual action moment shapes the exact division between the perceptual images of all manifest positions of the tennis ball (shown in red) and the perceptual images of all latent future positions of the tennis ball (shown in green).

Ergo the explanatory model brings forward a continuous compelling coupling of all perceptual images present during a motoric action. In which it makes no difference at all whether they are 1. manifest, 2. actual or 3. still latent perceptual images and which inter alia shows that the actual perceptual image always shapes the exact division between all manifest and all latent perceptual environmental object needs to consist of interconnecting positions of that object and due to which one can easily accept that motoric actions evolve in *time*-lines or action *time*-lines.

The four (root) articles show a wide variety of environmental objects. It covers a broad part of the spectrum of motoric movement actions which are a part of our daily rituals. So the explanatory model factually shows that within lots of common daily actions the perception of the actual position P (0) of a moving environmental object is essential but that it only gets significance in relationship to all past (manifest) positions P (-x) and all future (latent) positions P (+x) and linked that to all discoveries within the field of the processing processes of the perception. Completely conform the evolving insights within the scientific literature in relationship to the cortical streams. Which links the ventral stream with the processing of all perception processes mainly towards the whole action trajectory shape and vice versa links the dorsal stream to the processing of all perception processes mainly towards the actual position of the environmental object. However conform the very essential goal of this process and the developments within the aforementioned scientific literature the explanatory model doesn't consider isolated autonomous operating streams but conversely assesses the processing processes of the perception as a double and mutual process. Ergo it considers the ventral stream to process all perceptions mainly towards the action trajectory shape but with a definite relationship to the perception of the actual position of the environmental object and vice versa it considers the dorsal stream to process all perceptions mainly towards the actual position of the environmental object but with a definite relationship to the perception of the action trajectory shape.

<u>The goal of the cortical streams encompasses a demarcation process – Constructing *precise* perceptual images versus constructing *precise global* perceptual images</u>

In contrast to the common idea that our perception processes have the goal to construct *precise* perceptual images of future positions P of a moving environmental object the explanatory model shows that this phenomenon is finally clarified out of an opposite demarcation idea. So it much more encompasses an opposite process in which the cortical streams have the sole goal c.q. are only capable of having the goal to achieve a (very strong) reduction of future (movement-)possibilities. Because if you really will understand the essence of how we process perceptual images and how that is related to the perception-action coupling then you will see a huge essential problem. The system that we use within every motoric movement action indeed creates perceptual images of possible and very probable future (latent) positions P (+x) of the environmental object but it can never predict the exact future positions. Due to the fact that any environmental object will be capable to randomly deviate at any given position P (+x) a precise prediction is factually impossible but besides that fact it was never the goal within the development of our perception processes. Our perception processes solely provide the possibility to narrow down *global* perceptual images to more *precise global* perceptual images. If we were only capable to act when we have received very precise information than that would take away essential time of a possible proactive phase. So we don't try to create an exact perceptual image of the future movements of an environmental object but within a very short time span we try to achieve a huge reduction in possible future positions P of an environmental object. Which latter thought exactly fits into the most optimal ecological clarification. We try as *parsimonious* as possible to put the most likely deviations to occur within a corridor which will enable us to start to act in the shortest moment of time possible. So again if a ball has just been hit we don't need to catch it right away but if we are capable of constructing a perceptual image of where it approximately (*precise global*) will land we are capable to proactively move towards that area.
So the explanatory model of the motoric movement action clarifies with the (root) articles that due to the aforementioned system we are capable to anticipate to the fluctuation borders of the movements of an environmental object but that it clearly states that we will never ever know any future movement for sure because that is factually impossible. And that essence exactly shows the function and the profundity/weight of the processing processes of the perception. Within every motoric action anew the cortical streams will have to accompany an optimization process which always needs to be monitored till the last moment of the action. At *t* (0) in time a perceptual image of a latent action trajectory shape will need to lead within the action till at *t* (+1) the environmental object strays and provides a renewed perceptual image of the last part of the action trajectory shape which will have to lead again till at *t* (+2) the environmental object deviates again etc. etc..

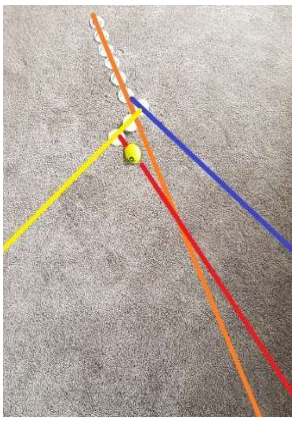
The double and mutual relationship of the ventral and dorsal stream leads to a *zigzag*-process

So with every added new time frame the processing of all perceptions towards the ventral stream will create new c.q. renewed perceptual images of the latent part of the ball trajectory shape. It will have to serve as a compelling guide for the dorsal stream until a deviation of the environmental object occurs in relationship to that latent action trajectory shape. This deviation will have to provoke the ventral stream to an adjustment of the previous perceptual image and then again will have to serve as a guidance for the dorsal stream till the next deviation will occur. So they mutually support each other c.q. are influencing each other continuously and they alternately are leading and following within the processing processes of the perception during the execution of the motoric action.

"*It takes about one-tenth of a second for information about the visual scene to reach the back of the brain or the occipital lobes. During the next tenth of a second, the visual information is analysed in two separate ways.*[10]"

You are capable to empirically draw the conclusion that it is very likely that one isn't capable of independent and continuous processing two completely separate perceptual images and the explanatory model therefor brings forward the ecological conclusion that a ball within an incoming ball trajectory shape alternately will be more dominantly present within the processing processes of the perception. Which logically can be related to the reaction time which is specified accurately within current scientific literature and which with other words can be explained that we *zigzaggingly* perceive an approaching ball within an incoming ball trajectory shape. So it is very likely that an identical incoming ball trajectory shape within this system will always be processed differently. Even when the same person is involved. Our body never ever had the desire to strive for identical evolving perception processes[11]. It is the only concern that again and again the fluctuation borders of future deviations will lead to such a narrow corridor that you are capable to catch the ball easily *at the end* (!) of the incoming ball trajectory shape[12].
images of the environmental object. Notion of this phenomenon also creates the understanding that perceptual images are always linked in time. Which leads to the factual knowledge that movement of whatever





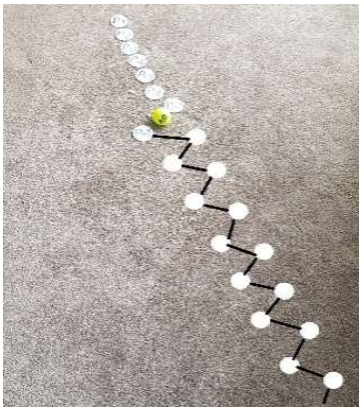
[10] Cerebral Visual Impairment - Working Within and Around the Limitations of Vision; Gordon N Dutton; http://www.liv.ac.uk/~pcknox/Publications/trimble/CVI%20chapter%20for_hers-Dutton.pdf
[11] The ecological principal of parsimony (efficient and effective) can't find one legitimate explanation for this idea.
[12] By the way the explanatory model provides the full explanation of all functional perception processes during the catching of a ball. It shows that not only the ball is perceived within a corridor which narrows down each ongoing time unit but that also the throwing c.q. the movement of the hand passes through the same narrowing process. Within the catching of a ball we experience a ball approaching us zigzagging within an action trajectory shape but we also experience the movement of the hand zigzagging within an action trajectory shape to an intersection point of the two action trajectory shapes.

Images: The enlarged *zigzag*-process within the cortical streams[13] - Out of an ecological approach the explanatory model clarifies that the processing processes of the perception alternate between 1. dominantly perceiving the actual position of the ball in relationship to the complete ball trajectory shape (dorsal stream) and 2. dominantly perceiving the complete ball trajectory shape in relationship to the actual position of the ball (ventral stream). The enlarged images[14] (from the 6th ball) show that process in several compositions. The occurring deviations within the double and mutual processing of the perceptions will continuously construct new perceptual images of the continuation of the incoming ball trajectory shape. The deviations within the width (x-axis) and within the length (y-axis) are processed autonomously. The deviations within the width (x-axis) will finally determine *where* (!) the ball will end and the deviations within the length (y-axis) c.q. the perception processes in relationship to the *tau*-value will finally determine *when* (!) the ball will arrive at the end of the incoming ball trajectory shape.

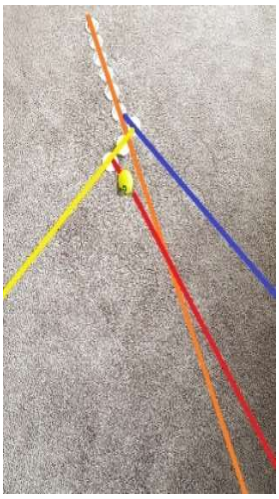
a. The *zigzag*-process – The autonomous processing of the deviations within the width (x-axis) of the incoming ball trajectory shape

The notion that the cortical streams are involved within a highly serious and complex process is additionally acknowledged if you start to understand that the perception of every moving environmental object compels multiple autonomous phenomena. The most important phenomena can be derived from the sole words *line* (y-axis) and *shape* (x-axis) which occur in the compound terms *line segment shape* or *action trajectory line segment shape*[15].
The perception processes in relationship to the x-axis will finally determine *where* (!) the ball will end and the perception processes in relationship to the y-axis will finally determine *when* (!) the ball will arrive at that end. The phenomenon within the processing processes of the perception in relationship to the deviations within the x-axis can be covered with the term *zigzag*-process. The phenomenon within the processing processes of the perception in relationship to the deviations within the y-axis can be covered with the term *harmonica*-process. This paragraph compels the *zigzag*-process.

The previous shown images show the *zigzag*-process crystal clear. The first image just portrays the simple principle of the processing processes of the perception in regard to the *zigzag*-process. Although a ball might factually produce a straight line segment shape the image shows that our processing processes mediate this incoming ball within two exclusive pathways. With the same simple explanation the explanatory model of the motoric movement action shows that we bring our hand within an action trajectory shape towards an intersection point of the two line segment shapes at hand in the exact same *zigzagging* way[16]. Due to which the catching of a ball can only be assessed as an optimization process that every time will have to be executed anew.



[13] The *zigzag*-process becomes very apparent if one wants to complete a nerve spiral: The cortical streams mediate the grasping of a coffee cup in the exact same way as they mediate the execution of the nerve spiral.
[14] The image at the left is the most schematic of the three shown images. The middle and right images are more representative for what is really happening.
[15] Within previous articles the differences are appointed extensively. In here only a limited explanation it is explained that the filling of a line relates exclusively to the *tau*-value within the perception processes. This means that the perception processes within this part are solely occupied how fast an environmental object fills an action trajectory shape c.q. are solely occupied how fast a perceptual image of the latent action trajectory shape disappears. It is not interested in any shape at all.
[16] The cortical streams mediate the grasping of a coffee cup in the exact same way as they mediate the execution of the nerve spiral of The final explanation of the function of the cortical streams during the grasping of a coffee cup



The two other images with the coloured lines much more represent the reality. They show an obvious *zigzag*-process but with a much more quirkier progression of the processing processes then the first image might suggest. At the moment that we enlarge the deviations the purple/lila coloured line segment shape shows a deviation in relationship to the manifest orange line segment shape. Within the ventral stream this results in a perceptual image of a whole purple action trajectory shape until at a random moment the ball deviates from that line within the dorsal stream when it is going to suggest the yellow action trajectory shape. Then all perception processes will act upon the perceptual image of the yellow line until again a deviation occurs and the red line is suggested etc. etc.. So under more normal circumstances the *zigzag*-pattern is more resembled by the image on the right although it must be remarked that the transitions from the colours orange to purple to light yellow to red to blue to dark yellow and to green probably still encompass a strong simplification of the actual involved perception processes.

Again it needs to be emphasized that processing processes of the perception are definitely not occupied with perceiving the actual truth. The goal of the perception processes is definitely not to unravel all exact positions of the ball. The sole goal and therefor the ultimate parsimonious goal of the perception processes is that at the end of the incoming ball trajectory shape deviations are recorded within such narrow boarders that it for example allow us to catch the ball. So if you endlessly had to catch the (identical) incoming ball as shown in the images then every time anew you finally will arrive at the same end of the incoming ball trajectory shape but with every a different set of processing processes of the perception. Your *zigzag*-process will always show a different pattern.

b. <u>The *harmonica*-process – The autonomous processing of the deviations within the length (y-axis) of the incoming ball trajectory shape</u>

The notion that the cortical streams are involved within a highly serious and complex process is additionally acknowledged if you start to understand that the perception of every moving environmental object compels multiple autonomous phenomena. The most important phenomena can be derived from the sole words *line* (y-axis) and *shape* (x-axis) which occur in the compound terms *line segment shape* or *action trajectory line segment shape*[17].
The perception processes in relationship to the x-axis will finally determine *where* (!) the ball will end and the perception processes in relationship to the y-axis will finally determine *when* (!) the ball will arrive at that end. The phenomenon within the processing processes of the perception in relationship to the deviations within the x-axis can be covered with the term *zigzag*-proces. The phenomenon within the processing processes of the perception in relationship to the deviations within the y-axis can be covered with the term *harmonica*-process. This part compels the *harmonica*-process.
In what time an environmental object will fill an action trajectory shape solely compels the time span in which the perceptual image of the latent line segment shape will disappear. The explanatory model clarifies this phenomenon by showing that a perceptual image of a manifest line segment shape is going to completely fill a latent action trajectory shape in which the latent part gradually (the *tau*-value) will

[17] Within previous articles the differences are appointed extensively. In here only a limited explanation it is explained that the filling of a line relates exclusively to the *tau*-value within the perception processes. This means that the perception processes within this part are solely occupied how fast an environmental object fills an action trajectory shape c.q. are solely occupied how fast a perceptual image of the latent action trajectory shape disappears. It is not interested in any shape at all.

become zero[18]. So this phenomenon has no relationship whatsoever which shape the action trajectory will finally construct but solely with the factual phenomenon that an environmental object will encounter deviations (within the perceptual image of the latent action trajectory shape) in time solely in relationship to the length of the line. As opposed to the clarification of the deviations within the width (x-axis) of the incoming ball trajectory shape it is much harder to illustrate the *harmonica*-process with animations. However the next written explanations will clarify the whole phenomenon clearly.
Within tennis (an original outdoor sport) each pro player will have to learn to cope with outdoor conditions and especially the wind. It will not occur often but imagine that huge gusts of wind are causing a tennis ball to heavily accelerate and heavily decelerate consecutively five times in a row. Due to the relative changes in speed it will have the consequence that the processing processes of the perception alternately witness a fast approaching ball and a slow approaching ball to the intended intersection point with the tennis racket head[19]. During the deceleration we perceive the consecutive positions P of the tennis ball closer to each other and vice versa during the acceleration we perceive the consecutive positions P of the tennis ball wider apart within the same time span. Which can obviously be described as a *harmonica*-process. Perceptions are stretched and pressed like a harmonica.
Now from this very odd example we move on to a more common example. Tennis balls relatively often come in touch with the net cord due to why they often decelerate or touch the lines due to why they often skid and accelerate. Which will also cause a change in the shape of the ball trajectory but definitely will cause that the ball will fill the ball trajectory shape in an obvious modified time span.
In the second example the *harmonica*-process remains quite obvious but now you have to extrapolate this to the micro level. Because at that micro level each ball within an incoming ball trajectory shape will also deviate endlessly in time at any position P due to the changing environmental conditions (wind, air composition, etc.). Even if you would succeed to create (the beginning of) identical ball trajectory shapes then every ball is capable to deviate in time randomly within each distance unit. That is just a mere fact that within most cases doesn't lead to practical consequences. Because in most cases the actual deviations of the tennis ball will remain far within the fluctuation boarders of the expectations of professional players. By training for years they have obtained broad cognitive knowledge of those boarders and are capable to easily cope with them.
Again it needs to be emphasized also in relationship to the deviations in the length of the incoming ball trajectory shape that the processing processes of the perception are definitely not occupied with perceiving the actual truth. The goal of the perception processes is definitely not to unravel all exact speeds of the ball during its whole flight. Also in here the sole goal of the perception processes is to get a grip on the *time*-corridor in which the ball will approach at an end point. That is the most parsimonious way. So if you endlessly had to catch the (identical) incoming ball as shown in the images then also in relationship to the deviations within the length (y-axis) you finally will arrive at the same end of the incoming ball trajectory shape but with every time a different set of processing processes of the perception.

[18] Within the original work of D.N. Lee this phenomenon is also described as the disappearing of the gap ("*Mind the gap*!"). Ergo the explanatory model defines the gap as the part *between* (!) the end of all manifest positions of the environmental object and the end of the whole perceptual image of the action trajectory shape.
[19] Tau-coupling theory 2.0 - The tennis ball creates a line segment shape, the tennis racket head creates a line segment shape; the intersection point creates c.q. affords the opportunity to let two tau-values approach to zero